

POPULAR SCIENCE

November

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MONTHLY
Mechanics & Handicraft



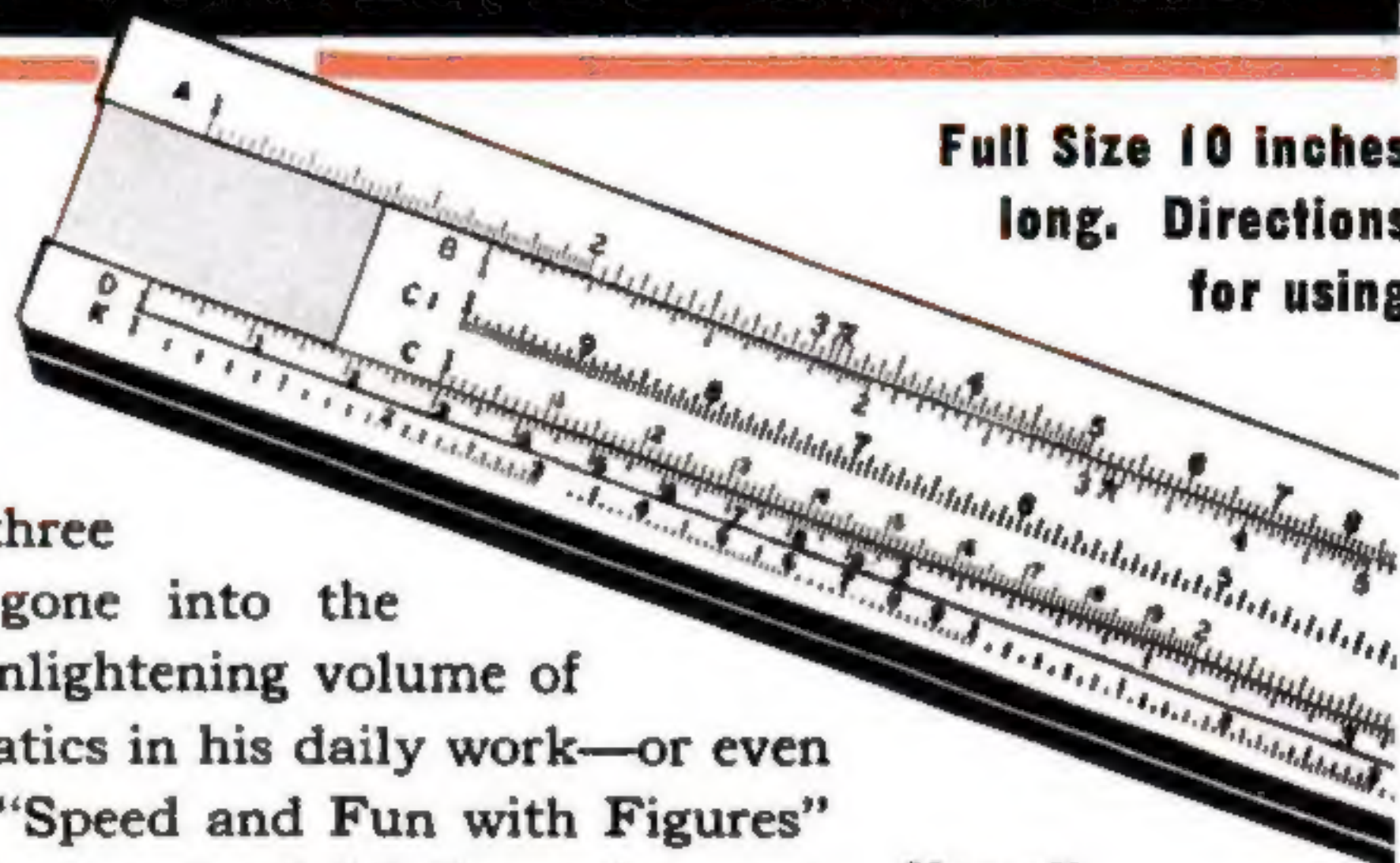
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Volume 135, No. 5

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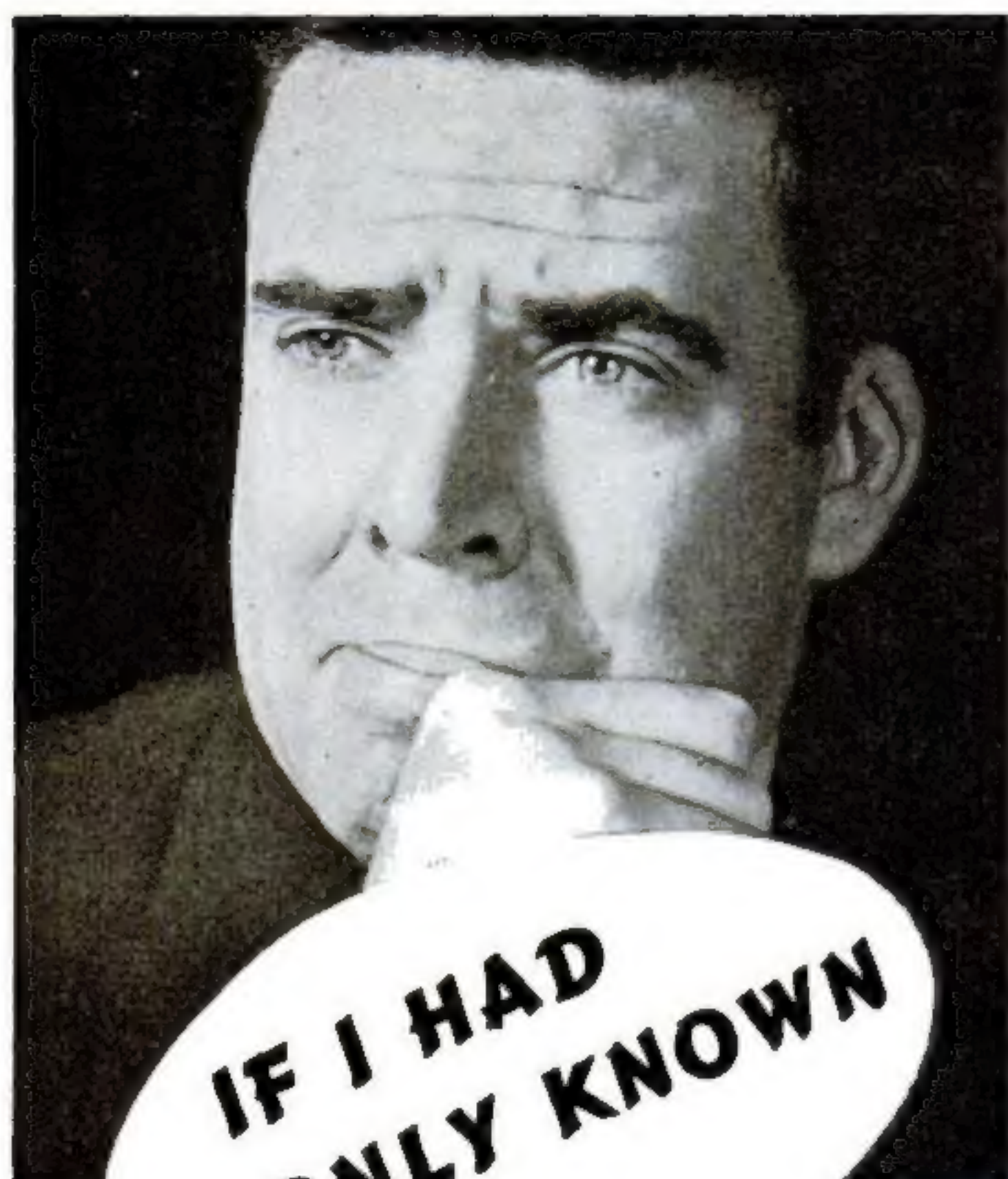
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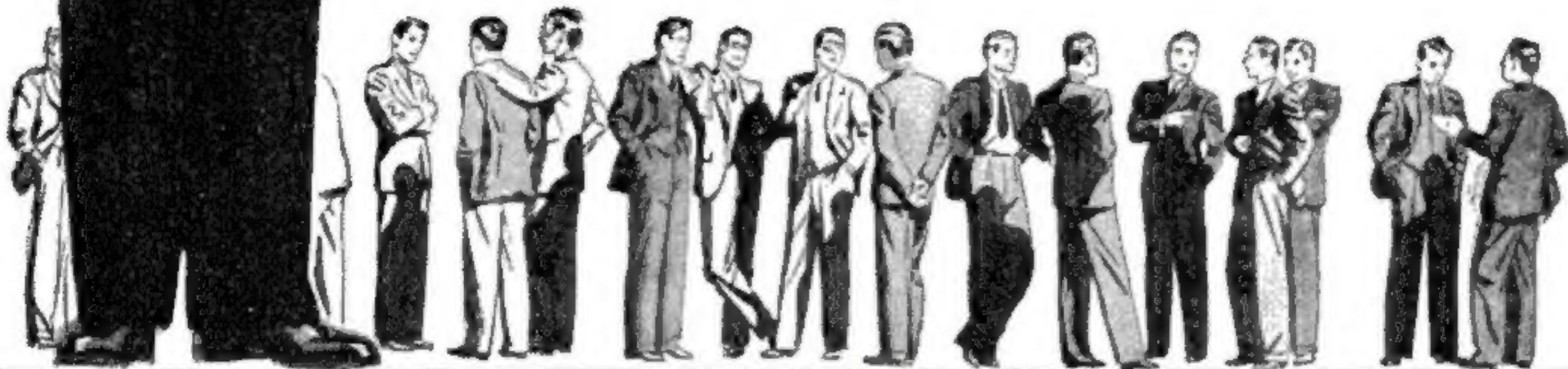
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SOMEWHERE there is a Tom Smith—that name is as good as any—who is practically flat broke, back on his heels and discouraged today. Perhaps he's in debt. Perhaps, as far as his job is concerned, he's in a rut. Perhaps he's just a victim of these trying times. Yet—he still has vision, imagination. And—ambition. He still believes that he's going *somewhere* . . . somehow, some way, some time. He hasn't given up hope. He still believes in success and opportunity.

Tom Smith will read this advertisement. No—there is a better way of saying it. Tom Smith *will study* this advertisement. He will read it once, then again, then yet again. It will strike a responsive chord somewhere within him. It will stir his dormant ambition, give wings to his imagination, set his vision afire. And he will *act!* As though Hope—as swift and powerful as lightning when it strikes—had suddenly taken possession of him, he will take advantage of the opportunity this advertisement offers him. And then—

Six months from now, his friends may say, "Have you heard about Tom Smith? Yes—just got a new job with an increase in salary." And two years later, the business journals in his field may report, "Thomas Smith Appointed Manager." And five years . . . or ten . . . or fifteen years hence, the sign on his office door may read "Thomas Smith, President."

All because Tom Smith had the vision, the imagination, the ambition, to recognize the significance of this advertisement. Because he had the foresight to see that there was his way to opportunity.

* * *

This page advertises the training of LaSalle. It is a unique institution in many respects. It utilizes Uncle Sam's postal service in its contacts with its students. It is the school for those men and women who work by day in every type of business and profession. It is the school of the clerk ambitious for success in accountancy. It is the school of the business man with an eye upon an executive position. It is the school of men and



women, young and middle aged, who wish to become accountants, bankers, sales managers, traffic experts or specialists in some one of fifteen different fields. In short, it is the school for ambitious people, determined to succeed, who recognize that only by thorough specialized training can they reach their objectives.

In the history of LaSalle, there have been more than 1,000,000 such men and women. They have gladly substituted night hours of study for night hours of aimless pleasure. They have sacrificed hours of minor enjoyment to reach years of major success. They have studied hard—accumulated the accurate, comprehensive and practical training LaSalle offers by its famous Problem Method—thus wresting from Life the success which long before many had thought was not for them.

The LaSalle Method is comprehensive, yes. It is accurate, up-to-the-minute and alive. It is invaluable training. But above all things, it is a Road Towards Success. It is not an easy road. It is not the road for sluggards, for those who refuse to sacrifice and work. Rather, it leads to their destination only those who have the will to *finish* what they have once *begun*.

* * *

Perhaps you think that prophecy of Tom Smith's career mentioned above is pure fantasy. Perhaps you feel it is solely the product of an advertising writer's imagination. If such are your beliefs, you are wrong. For that prophecy is based upon past experience—

The past experience of thousands of discouraged Tom Smiths who read just such an advertisement as this years ago. Tom Smiths with vision and ambition and imagination who accepted LaSalle's offer of one of the booklets listed below. And—who found the booklet so intriguing, so full of hope, that they enrolled in LaSalle . . . and as the months passed, they found themselves rising out of their rut, reaching toward more attractive and better-paying jobs. Finally, achieving rich and deserved success in their chosen lines.

Tom Smith, wherever you are, whoever you are, whatever are your ambitions—here is your opportunity! Are you going to pass it by?

LaSalle Extension University A Correspondence Institution

Dept. 1183-R, Chicago

I am in earnest about my success and I would like to have your special booklet—without any cost or obligation to me—about my opportunities and your success training in the business field I have checked.

- | | |
|--|--|
| <input type="checkbox"/> Business Management | <input type="checkbox"/> Industrial Management |
| <input type="checkbox"/> Higher Accountancy | <input type="checkbox"/> Modern Foremanship |
| <input type="checkbox"/> Traffic Management | <input type="checkbox"/> Business Correspondence |
| <input type="checkbox"/> Commercial Law | <input type="checkbox"/> Business English |
| <input type="checkbox"/> Law: Degree of LL. B. | <input type="checkbox"/> Effective Speaking |
| <input type="checkbox"/> Modern Bookkeeping | <input type="checkbox"/> Office Management |
| <input type="checkbox"/> C. P. A. Coaching | <input type="checkbox"/> Stenotypy |

Name _____ Age _____

Position _____ Address _____

Ask for one of these Booklets—or a similar one on your own field of business. They are free!



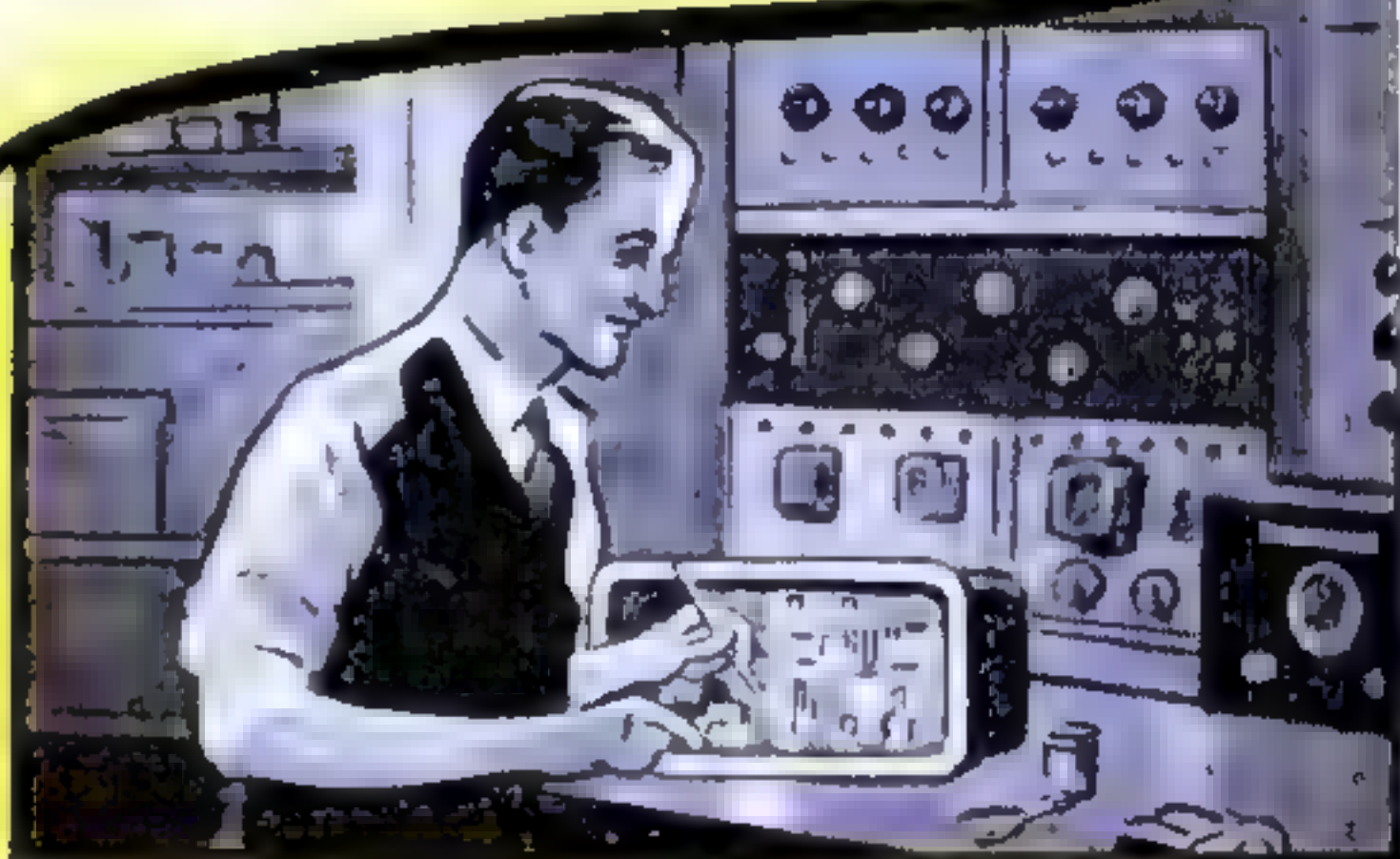
I Jumped from \$18 a week to \$50

--A FREE BOOK STARTED ME TOWARD THIS

Good Pay in Radio

--- HERE'S HOW IT HAPPENED

by S.J.E. (NAME AND ADDRESS SENT UPON REQUEST)



"When I finished training I accepted a job as serviceman with a Radio store. In three weeks I was made service manager at more than twice what I earned in the shoe factory."

Be a RADIO

Find out How I Train

RADIO IS A YOUNG, growing field with a future, offering many good pay spare time and full time job opportunities. And you don't have to give up your present job to become a Radio Technician. I train you right at home in your spare time.

Why Many Radio Technicians Make \$30, \$40, \$50 a Week

Radio broadcasting stations employ engineers, operators, station managers. Radio manufacturers employ testers, inspectors, foremen, servicemen in good-pay jobs. Radio jobbers, dealers, employ installation and service men. Many Radio Technicians open their own Radio sales and repair businesses and make \$30, \$40, \$50 a week. Others hold their regular jobs and make \$5 to \$10 a week fixing Radios in spare time. Automobile, police, aviation, Commercial Radio; loud-speaker systems, electronic devices are other fields offering opportunities for which N. R. I. gives the required knowledge of Radio. Television promises to open good jobs soon.

Many Make \$5, \$10 a Week Extra in Spare Time While Learning

The day you enroll, I start sending you Extra Money Job Sheets which start showing you how to do Radio repair

Makes \$50 to \$60 a Week

"I am making between \$50 and \$60 a week after all expenses are paid, and I am getting all the Radio work I can take care of, thanks to N. R. I."

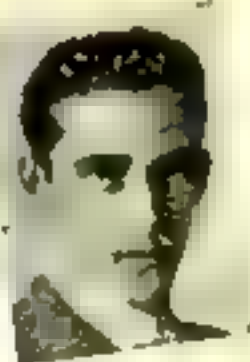
H. W. SPANGLER
126½ S. Gay St., Knoxville, Tenn.



Over \$1,000 Before Graduating

"Before completing half the N. R. I. Course I was servicing sets, and I made \$1,000 to \$1,200 before graduating. I am doing Radio service work for myself now."

ASHLEY G. ALDRIDGE
1228 Shepherd St., Petersburg, Va.



\$10 to \$25 a Week in Spare Time

"I am now making from \$10 to \$25 a week in spare time while still holding my regular job as a machinist. I owe my success to N. R. I."

WM. F. RUPP
611 Green Street, Bridgeport, Pa.

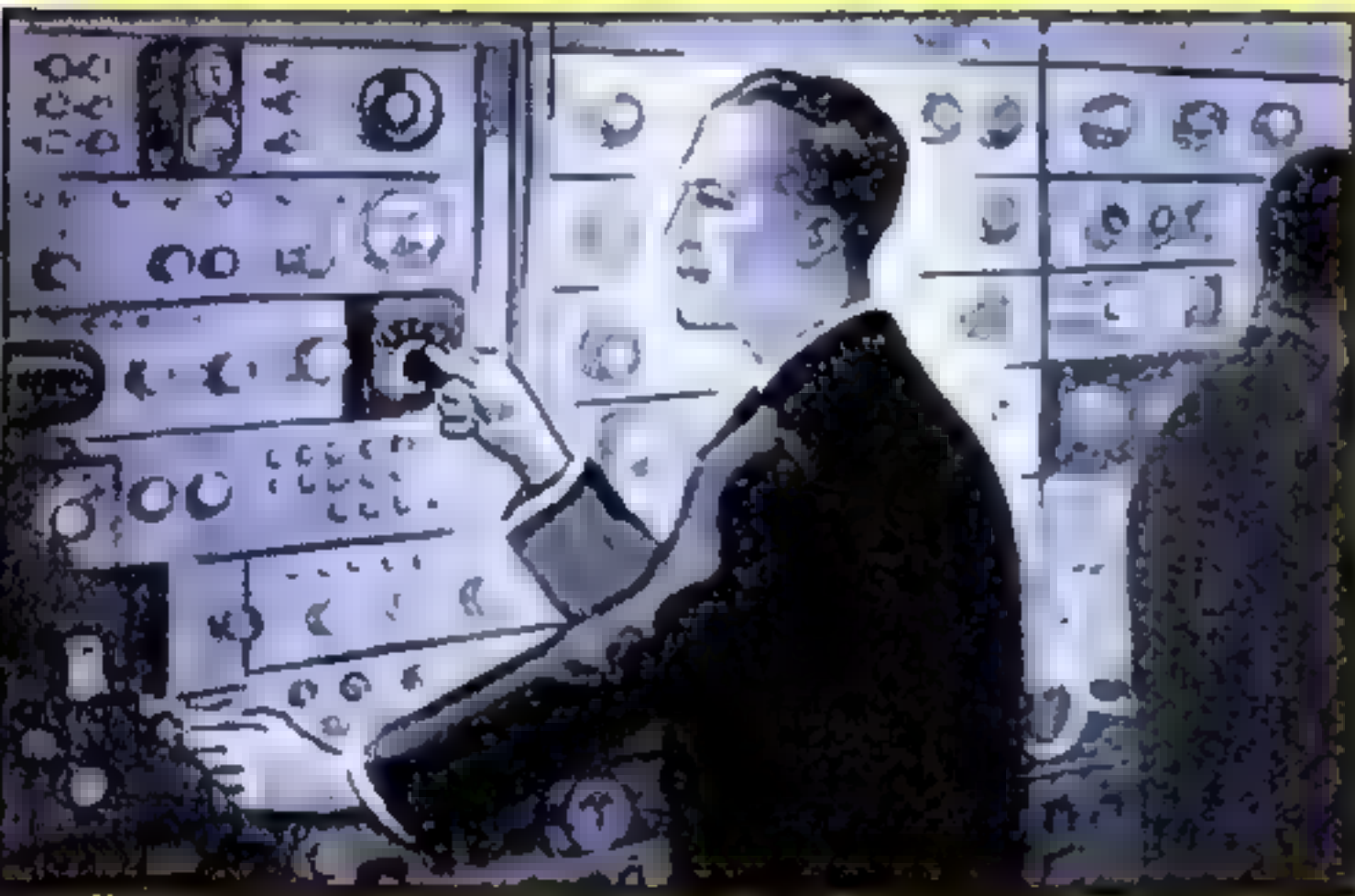




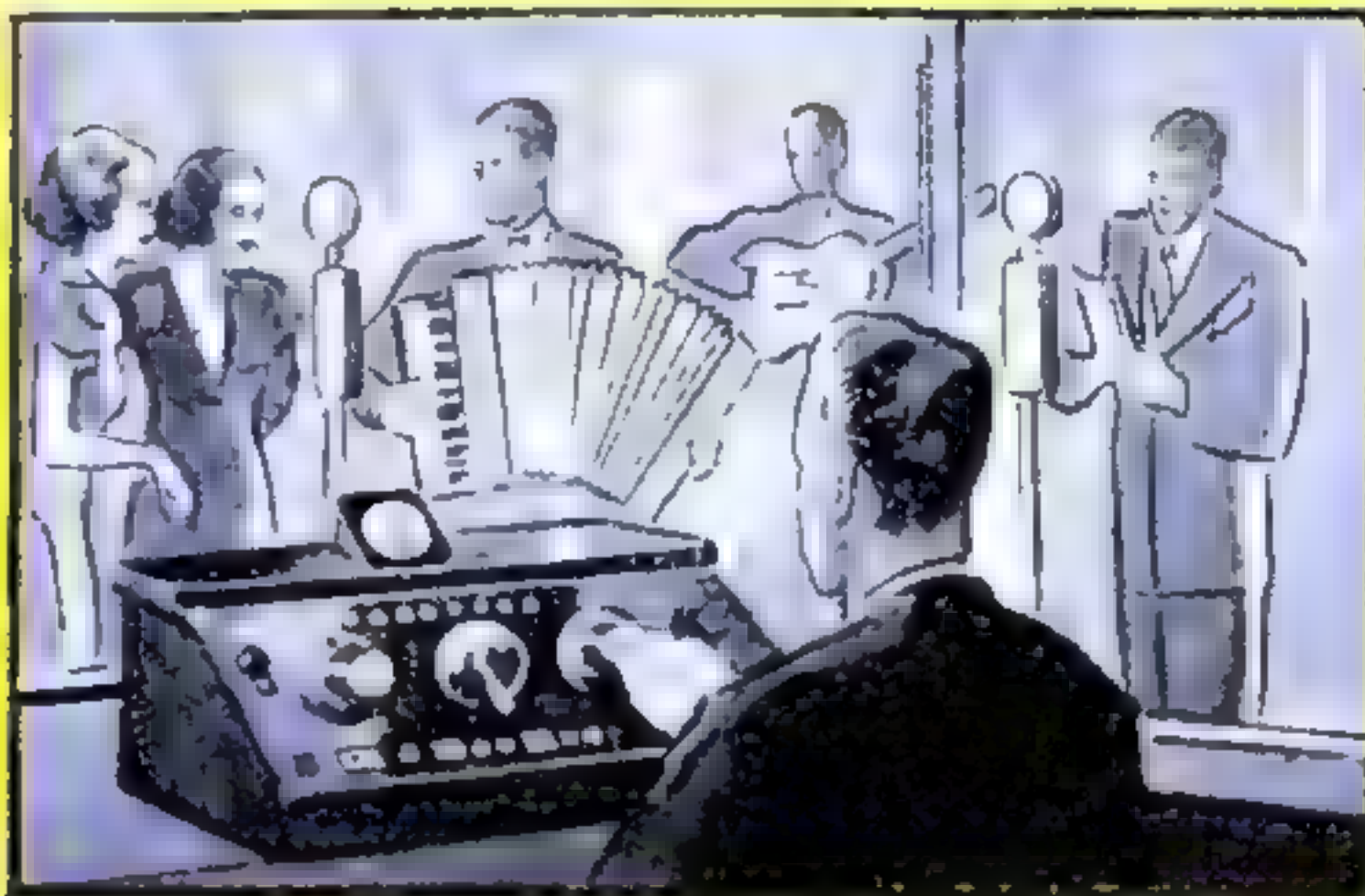
"I had an \$18 a week job in a shoe factory. I'd probably be at it today if I hadn't read about the opportunities in Radio and started training at home for them."



"The training National Radio Institute gave me was so practical I was soon ready to make \$5 to \$10 a week in spare time servicing Radio Sets."



"Eight months later N. R. I. Employment Department sent me to Station KWCR as a Radio operator. Now I am Radio Engineer at Station WSUI. I am also connected with Television Station W9XK."



"N. R. I. Training took me out of a low-pay shoe factory job and put me into Radio at good pay. Radio is growing fast."

Technician You at Home



J. E. SMITH, President
National Radio Institute
Established 25 Years

He has directed the training of more men for the Radio Industry than anyone else.



jobs. Throughout your training I send plans and directions which have helped many make \$200 to \$500 a year in spare time while learning. I send special Radio equipment to conduct experiments and build circuits. This 50-50 training method makes learning at home interesting, fascinating, practical. I ALSO GIVE YOU A MODERN, PROFESSIONAL ALL-WAVE, ALL-PURPOSE SET SERVICING INSTRUMENT to help you make money fixing Radios while learning and equip you for full time work after you graduate.

Find Out What Radio Offers You

Act Today! Mail the coupon for my 64-page book, "Rich Rewards in Radio." It points out Radio's spare time and full time opportunities and those coming in Television; tells about my course in Radio and Television; shows many letters from men I have trained, telling what they are doing and earning. Read my money back agreement. MAIL COUPON in an envelope or paste on a penny postcard—NOW!

J. E. SMITH, President
Dept. 9MP3, National Radio Institute, Washington, D. C.

MAIL THIS NOW
Get 64 Page Book Free

J. E. SMITH, President, Dept. 9MP3,
National Radio Institute, Washington, D. C.


Dear Mr. Smith: Send me FREE without obligation, your 64-page book "Rich Rewards in Radio" which points out Radio's opportunities and tells how you train men at home to be Radio Technicians. (Write Plainly.)

NAME..... AGE.....

ADDRESS.....

CITY STATE

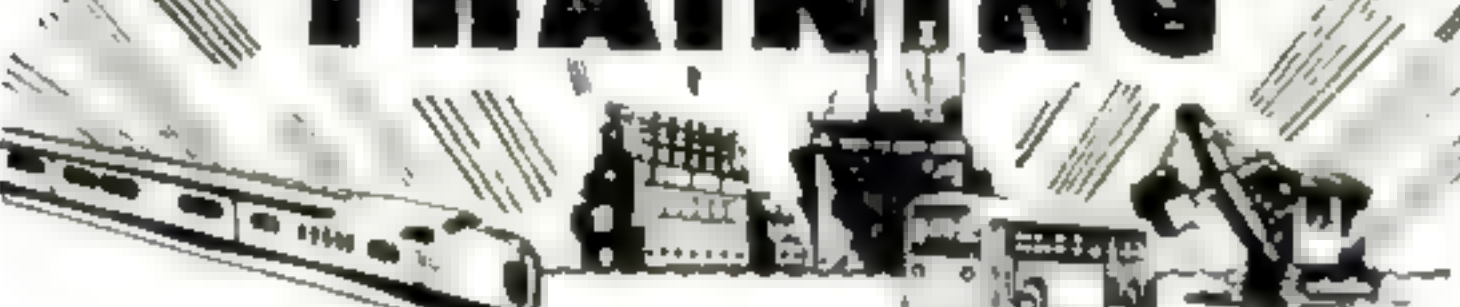
FOR MEN WHO WANT TO LEARN A PROFITABLE TRADE



Complete

DIESEL

TRAINING



**NO MATTER WHERE YOU ARE
OR WHAT YOU DO**

—we have a training plan for YOU!

IF you are sincerely ambitious and interested in making good in the Diesel field, be sure to immediately investigate our flexible training plan that will fit your circumstances. A Plan for every Man. A Plan for those seeking immediate shop training as well as for those who cannot give up their present employment and income. For 34 years National Schools, a recognized leader in the field of trade education, has helped wide-awake men to success. This million-dollar trade school will supply you with a sincere, honest statement of facts of what you should do to quickly get into the profitable Diesel Industry. No exaggerations—no misstatements; and a definite plan to fit you.

**Write Today
For Full Details**

Mail the coupon below. Find out how you can get the finest in Diesel training without delay. See how this great trade school operates and makes its facilities available to every ambitious man. Actual work in modern training shops, a part of every man's instruction. Shop methods time-tested for 34 years. Fascinating, efficient preparation. Get the facts.

WE ARE DEFINITELY INTERESTED IN HELPING MEN OF LIMITED INCOME AND "BLIND ALLEY" JOB HOLDERS.

NATIONAL SCHOOLS
LOS ANGELES, CALIF.

Complete Training in
Diesels and Gas Engines

Oldest Trade School in West

Mail Coupon For FREE Literature



Request for Free Literature

NATIONAL SCHOOLS, (established 1905) Dept. 11-PSA
4000 South Figueroa Street, Los Angeles
Please send me, without obligation, your FREE LITERATURE and information.

NAME _____ AGE _____

ADDRESS _____ CITY _____ STATE _____

PARKS AIR COLLEGE
PARKS AIRPORT EAST ST. LOUIS, ILL.

**Offers YOU COLLEGE and PROFESSIONAL TRAINING
Majoring in AVIATION**

Accredited by the Illinois Superintendent of Public Instruction, U.S. approved as a Commercial Ground and Flying School and Mechanics School. Accredited by and cooperating with the United States Army Air Corps in giving flight and mechanical training. Open to high school graduates.

FOUR courses lead to B.S. degrees in Professional Piloting, Aviation Operations, Maintenance Engineering, Aeronautical Engineering. SEVENTEEN TRAINING PLANES are used in professional flight training which prepares graduates for airline flight operations. 74% of graduates enter air transportation in North and South America. 76,000 hours flight training given. 1800 hours being flown monthly. FACULTY of 43 specialists in various fields of aviation. 1769 graduates. Enrollment limited to a total of 300 commercial aviation students. Total enrollment 415. 100-acre airport, 18 buildings devoted to school purposes exclusively. Dormitories and dining hall at the College. Winter Term January 8. Send postcard for new 60-page catalog.

Registrar, Dept. PS-11
13th YEAR PARKS AIR COLLEGE, East St. Louis, Ill.

ENGINEERING

**DEGREE
IN TWO
YEARS**

TECHNICAL AND APPLIED COURSES. Nonessentials omitted. TIME AND MONEY SAVED. Degree 2 yrs., diploma 1 yr. Electrical, Mechanical, Architectural, Structural, Civil, Aeronautical, Highway. All courses include Air Conditioning, Electric Refrigeration and Diesel. Short intensive courses 3 and 4 months in Electricity, Power plant, Diesel-Electric, Electric Refrigeration, Drafting. Extensive modern equipment. LOW TUITION. Part-time work for room and board. Thousands of successful graduates in U.S. and foreign lands. Approved by Industry, endorsed by educators, recommended by alumni. One and two-year courses start in Sept., short courses open year round. 40th YEAR Residence courses. Catalog free.

FINLAY ENGINEERING COLLEGE
1003 Indiana Avenue Kansas City, Mo.

ELECTRICAL ENGINEERING

Condensed ONE-YEAR residence course combines theory with practice in well-equipped laboratories. High employment record. Suburban campus; modern buildings; dormitory. 47th year. CATALOG.

Give age.



BLISS ELECTRICAL SCHOOL

111 Takoma Ave., Washington, D. C.

Learn to play...

Easy lessons at home. Inexpensive. 182-page Music Dictionary FREE when you enroll. Stop lessons when you like. Money back guarantee. Write for free details. Hamann Institute, 3015 N. 24th Place, Dept. F-8, Milwaukee, Wis.

Hawaiian Steel Guitar
Spanish Guitar
Piano

**FREE TRIAL LESSON IN
DRAFTING**



More good jobs now in Drafting. Learn AT HOME in spare time (or at our Chicago School). Send post card for FREE TRIAL LESSON and see how easy to learn and get a good job.

CHICAGO TECHNICAL COLLEGE
P-216 Tech. Bldg., 118 E. 26th St., Chicago, Ill.

**CARTOON YOUR WAY
TO SUCCESS!**



DON'T COPY - LEARN TO ORIGINATE!

RAYE BURNS will teach you HOW to CREATE ORIGINAL CARTOONS at home that you can SELL! Course has 26 lessons and 600 illustrations. **\$2.85**

Send name and address for free details. Only....

RAYE BURNS SCHOOL, Dept. S, Box 2194, CLEVELAND, O.

**BARGAINS!!!
Used Home-Study Courses
BOUGHT-SOLD-RENTED**

72-PAGE
ILLUSTRATED
CATALOG
FREE

Write today for big FREE illustrated catalog explaining this amazing service. Used correspondence courses and educational books on every subject. 100% satisfaction guaranteed. We buy for cash—we offer unbelievable bargains. Send your name on penny postcard at once! No obligation.

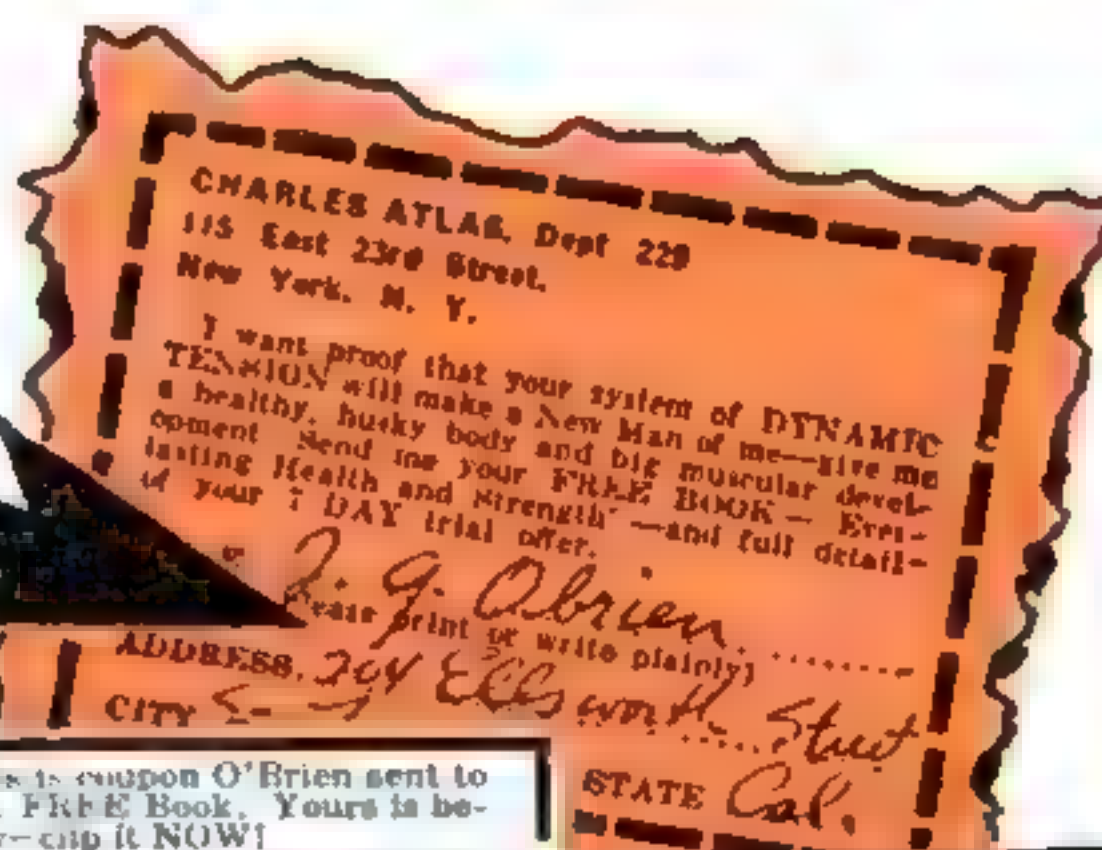
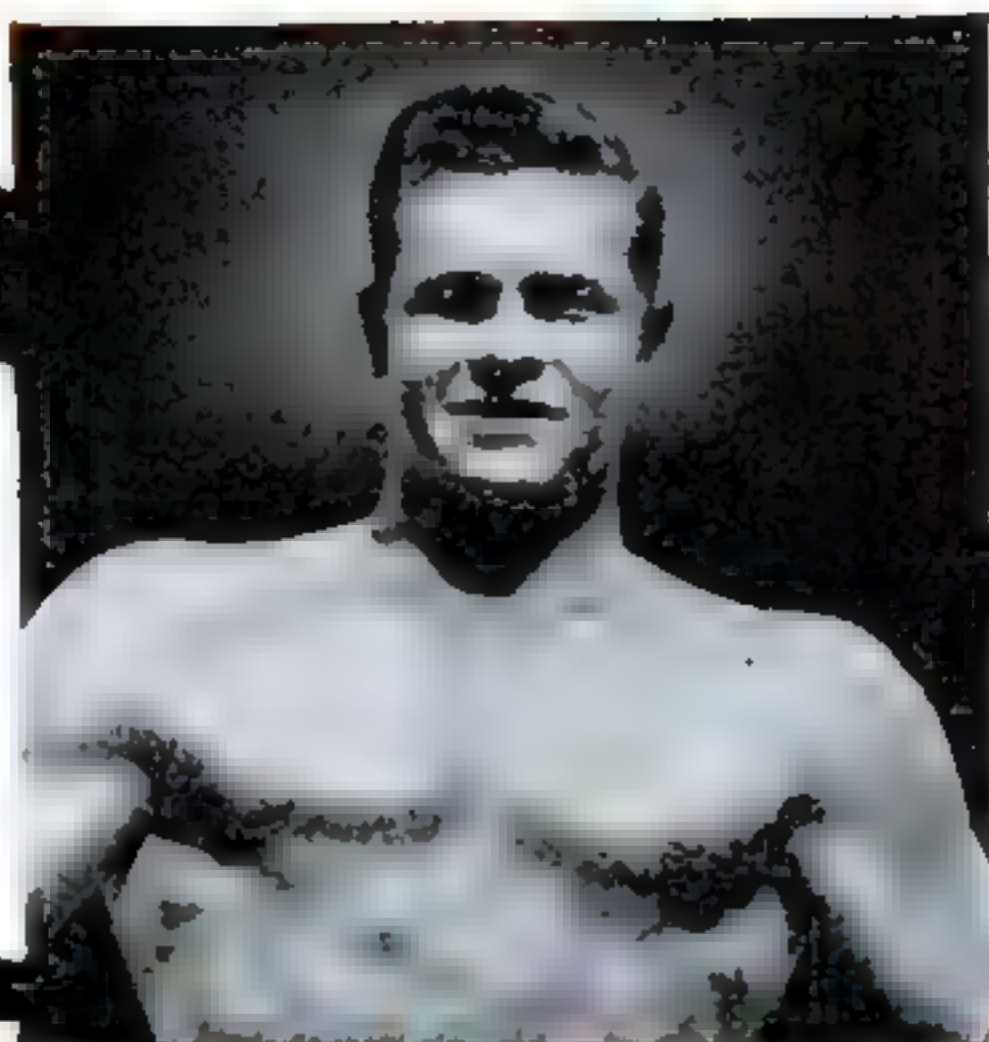
NELSON CO.
L-202 Manhattan Bldg. Chicago

HE Mailed This Coupon

J. G. O'BRIEN

Atlas Champion
Cup Winner

This is an ordinary snapshot of one of Charles Atlas' Californian pupils.



...and Here's the Handsome
Prize-Winning Body
I Gave Him!

J. G. O'BRIEN saw my coupon. He clipped and mailed it. He got my free book and followed my instructions. He became a New Man—and also won one of my Atlas-Champion, Sterling Silver Cups for his physical improvement. NOW read what he says:

"Look at me NOW! Dynamic Tension WORKS! I'm proud of the natural, easy way you have made me an 'Atlas Champion'!"

J. G. O'Brien

**Let Me Prove I Can Make
YOU a New Man!**

Would you like to have a handsome build — greater physical development — a strong, muscular body? Then listen to this:

I, myself, was once a skinny weakling of 97 lbs. I didn't know what real health or strength were. I was afraid to fight, ashamed to be seen in a swimming suit.

Then I discovered the secret that changed me into "The World's Most Perfectly Developed Man," the title I won twice and have held ever since, against all comers. My secret is Dynamic Tension. It is a natural method. Its purpose is not only to give you the powerful, rippling muscles you'd like to see in your own mirror, but also—for those whose systems are sluggish from lack of proper exercise—to help them tone up their entire body, inside and out.

Accept My 7-Day Trial Offer

Do you want a better build? Are you dissatisfied with your present physical development? All I ask is a 7-DAY TRIAL. Just one week! In even that short time you will notice your chest hardening and filling out with solid muscle—or the 7-Day Trial will

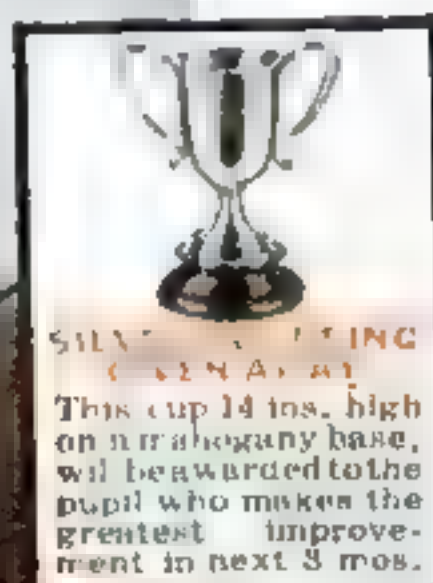
cost you nothing. Surely this is proof enough that by continuing with my "Dynamic-Tension" method I can make you a New Man—give you bodily power and drive, and put you in magnificent physical condition which wins you the envy and respect of everyone.

FREE BOOK

Let me show you the results produced for other men! I'll send you FREE my famous book, "Everlasting Health and Strength." It shows actual photos. Write your name and address carefully on coupon. Mail to me personally today. I'll rush your free copy to you AT ONCE! Charles Atlas, Dept. 1L, 115 East 23 Street, New York, N. Y.



An untouched photo of Charles Atlas, twice winner of the title, "The World's Most Perfectly Developed Man"



CHARLES ATLAS
Dept. 1L, 115 East 23rd Street,
New York, N. Y.

I want the proof that your system of Dynamic Tension can help make me a New Man—give me a healthy, husky body and big muscle development. Send me your FREE book, "Everlasting Health and Strength," and full details about your 7-DAY Trial Offer.

Name.....
(Please print or write plainly)

Address.....

City.....State.....

Our Readers Say



Sounds Like a Good Idea. Go Ahead and Try It Out

HAVING just got through with a siege of the painters, I've been wondering why some one doesn't design a

YEAH, AND THEN BE SORE BECAUSE YOU COULDN'T CHANGE THE COLOR SCHEME!



"paintless house." With stainless-steel walls, a plastic ceiling, and some sort of waterproof composition flooring provided with an inconspicuous gutter and drain, the problem of cleaning a room would be reduced merely to removing the furniture and washing it down with a hose. Such a

room would cost more, but then you don't exactly get painters to work for nothing.
—T. K. V., St. Louis, Mo.

How Can It Be Going Somewhere and Standing Still, Too?

RECENTLY a group of us were listening to an Army officer talking about the high-speed tanks that form an important part of the U. S. Army's newly formed mechanized units. Everything was understandable enough until he came to explain the operation of the rubber endless treads on which these fighting units run. If a tank is rolling along a road at twenty miles an hour, he said, at any given moment the top horizontal portion of the endless tread is moving at forty miles an hour, while the bottom horizontal section in contact with the ground is not moving at all! Now I don't doubt this statement, since an

officer in the mechanized cavalry wouldn't be an officer if he didn't know his onions, but I would like some patient person to explain to me in terms of one syllable just how a practically non-flexible, endless tread attached to a moving object can be at rest and also moving twice as fast as the object, all at one and the

same time. As I see it, that means that the tank is traveling twenty miles an hour faster than the bottom of the tread, and at the same time, loafing along twenty miles an hour slower than the top of the very same tread. To save my sanity, some one has got to give me the low-down on this, and soon.
—K. A. M., Chappaqua, N. Y.

GUESS IT'S RIGHT, MY HEAD'S DOIN' 90 AND, I'M STANDING STILL!



Even a Hurricane-House Owner Has Something To Worry About

THAT "hurricane house" described in your last issue has all the earmarks of a smart idea for a stiff breeze, but I hate to think what would happen if the weather-vane dwelling happened to be directly in the path of even a gentle "twister." Mr. Koch better build in a good set of four-wheel brakes if he doesn't want to wake up with a dizzy feeling some night and find everything spinning.—R. P. D., Topeka, Kan.

Those POTS and WOLS Will Drive Him STUN

TELL me, is this the United States—or China? I've just come back from a trip in my car, and there was one thing that just about drove me nuts. I mean this business of painting warning signs on pavements, with the letters arranged vertically to read from bottom to top. I realize that it is done that way because motorists are expected to read the nearest letter first, and so on. But you *don't* read them that way. You see the word as a whole, and naturally read it from top to bottom, as anybody except a Chinaman would. The result is that STOP becomes POTS, and SLOW becomes WOLS. Goodness knows, the roads are dangerous enough as it is, without motorists seeing POTS before their eyes, or suddenly encountering WOLS at a busy intersection. Let's go back to the good old American custom of writing from top to bottom.—M. E., Newark, N. J.

THAT DOES IT!



The Drought Was a Break for the B.O.E.A.P.Q.O.T.U.S.D.O.A.

SERIOUS drought last summer? Brother, you should have seen some of the farms around this vicinity late in July. Before it was over, nobody was worrying about such things as lightning bugs, mosquitoes, crickets, tree toads—no, not even about Japanese beetles! It's really about these last, however, that I'm writing. Your correspondent wondered if the drought might mean we could hope for fewer Japanese beetles next year. I recently read in the *(Continued on page 16)*

Training Counts in Every Field



International News Photos

You Must Know What to Do When Signals are Called

To play the game—whether on the football field or in the bigger jobs of business and industry—you must know what to do when the signals are called. To make the team a player must be above average—and you must be above average to meet the demands of employers for the better paid positions.

Your own ability to hold the better jobs depends entirely on the preparation you have made to accept the opportunities offered every month in the year in the active fields of today such as Air Conditioning, Diesel Engineering, Drafting and Design, etc. Men in these fields and others with preparation as accountants and in merchandising are being advanced into such openings as department heads, managers, foremen, superintendents, traveling auditors, etc.

Your opportunity today simply means being ready for the good jobs looking for good men—your chance for a worthwhile position depends on whether or not you will prepare to meet the demands of employers all over the country who are offering the big jobs to men who can handle them!

Without training a man is no more valuable at 40

than at 30, is old at 50. But the doctor at 40 or 50 is a better doctor than he was at 30—and it's the same with men trained in other fields—executives, draftsmen, engineers, merchants, architects are young at 40, at 50—and still have many good pay years ahead. Promotion, higher pay, reward properly trained men!

American School, an educational institution incorporated "not for profit," has used for over 40 years a direct and practical method for preparing men to handle the bigger jobs in business and industry.

American School graduates hold important positions as engineers, accountants, experts, draftsmen, managers, etc., or successfully operate their own business. Thousands of our High School graduates have entered colleges, universities, normal schools, etc., have attained success in business or industry.

Find out how American School can help YOU, the difference it may make in your entire future success and happiness! Mail coupon today for free Bulletin and early lesson in field of your choice. No obligation on your part.

American School, Dept. G846, Drexel Ave. at 58th St., Chicago

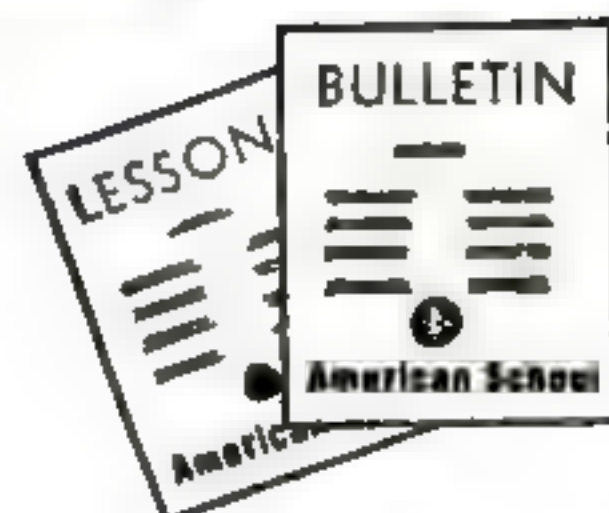
Cut Along This Line

Try a Lesson Yourself—No Obligation

American School, Dept. G846, Drexel Ave. at 58th St., Chicago

I have checked the line of work in which I would like a good job. Please send me without expense or obligation on my part a copy of your Bulletin and an early lesson in the field I have selected.

- | | | |
|--|---|---|
| <input type="checkbox"/> Air Conditioning | <input type="checkbox"/> Electrical Engineering | <input type="checkbox"/> Law |
| <input type="checkbox"/> Architecture | <input type="checkbox"/> Diesel Engineering | <input type="checkbox"/> Liberal Arts (College) |
| <input type="checkbox"/> Automotive Engineering | <input type="checkbox"/> Drafting and Designing | <input type="checkbox"/> Mechanical Engineering |
| <input type="checkbox"/> Automobile Repairing | <input type="checkbox"/> Electric Refrigeration | <input type="checkbox"/> Merchandising |
| <input type="checkbox"/> Bookkeeping and Cost Accounting | <input type="checkbox"/> Heating, Ventilating, Plumbing | <input type="checkbox"/> Private Secretary |
| <input type="checkbox"/> Business Management | <input type="checkbox"/> Professional Accounting | <input type="checkbox"/> Radio and Television |
| <input type="checkbox"/> Civil Engineering | <input type="checkbox"/> Incl. C. P. A. Coaching | <input type="checkbox"/> Salesmanship |
| <input type="checkbox"/> Aviation | <input type="checkbox"/> High School | <input type="checkbox"/> Shop Practice |
| <input type="checkbox"/> Contracting, Building | <input type="checkbox"/> Highway Engineering | <input type="checkbox"/> Steam Engineering |



Name _____ Age _____ Occupation _____

Street _____ City _____ State _____

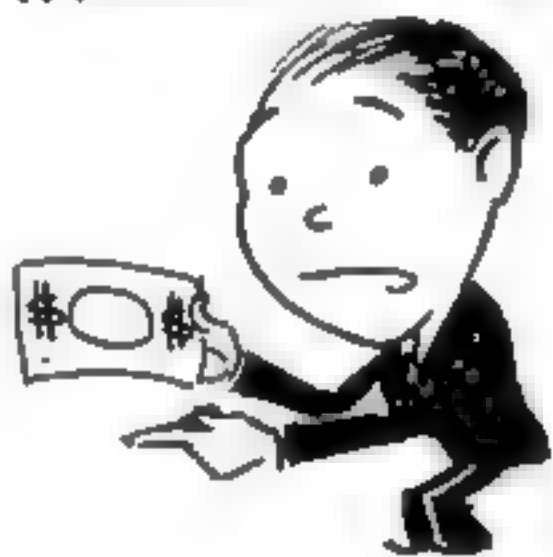
Our Readers Say (CONTINUED)

papers that this is so. It seems that the beetles lay eggs or something underground, and that when these hatch, the grubs need a lot of water. Lack of it kills a good majority of them. It's a break for us suburbanites and for (this mouthful always tickles me) the Bureau of Entomology and Plant Quarantine of the United States Department of Agriculture!—H. J., Morristown, N. J.

It looks as Though Some One Must Have Been Gyped

ONE of your bright math enthusiasts should toss this one off in stride. Smith left a \$100 bill with the proprietor of a hunting lodge while he went off on a week's hunting trip. The day after he left, one of the proprietor's creditors demanded payment on a \$100 note from the proprietor, who decided to pay up with the absent Smith's century and put it back later. The creditor immediately turned over the 100 smackers to his wife, who paid last year's coal bill with it. The coal dealer, delighted at the unexpected windfall, repaired to the hunting lodge and gleefully paid it over to the proprietor as final payment on a boat he'd bought from him. The proprietor, pleased to have the bill in his hands again, put it back in his safe. Presently, Smith returned from the hunt and asked for his money. When the proprietor handed it to him, Smith promptly threw it in the fireplace where it burned up. "It was a counterfeit bill that I found," Smith explained. "Before I went away I was planning to pass it off on somebody, but now I think better of it." Who got gyped?—R. G. N., Albany, N. Y.

MONEY'S VALUE IS ONLY THE CONFIDENCE OF THE PUBLIC IN IT AS A MEDIUM OF TRADE.



oxygen, reserve supplies of which could be and doubtless always are stored on board. —O. S., Fall River, Mass.

"Ship-to-Shore" Communication Will Be a Real Problem Then

THE planet Mars has just passed closer to the earth than it's been for more than a dozen years. It brings up a question that's been bothering me. Every so often we hear of supposed radio signals from places like Mars in outer space, and I'm wondering how we receive them—if they really do get here. As I understand it, the thing that makes radio reception possible is the layer of ionized atmosphere several miles up. Now, if radio waves bounce off the inside of this electric shell, wouldn't they also bounce off the outside, preventing them from reaching our receivers at all? What's going to happen to rocket-ship-to-earth communication if we ever should have interplanetary travel?—D. M., Glencoe, Ill.

MAYBE THE ROCKET SHIP WILL BOUNCE, RIGHT BACK, TOO!



He Had a Fine Ride—Except for the Battery-Acid Bath

F. H. asks why some one doesn't put an electric drive on bicycles. I've tried it, almost exactly as he proposed. The motor was a Model A Ford power-plant-type generator, operating as a series motor. The speed was around fifteen miles an hour on the level, but after some forty miles, the rider was so drenched with battery acid that he gave up the idea of using wet batteries on a bike.—A. J. M., Seattle, Wash.

THE GUY MUST HAVE BEEN A NUDIST AFTER THAT RIDE!



It's Not a Question of Oxygen, But How To Get Rid of the Water

NO ONE can disagree with the motives that prompted J. R. to suggest the emergency making of oxygen in submarines in distress by means of electrolysis of sea water. But I'm afraid he's barking up the wrong tree. In time of submarine disaster, the immediate problem is rarely one of oxygen supply, it seems to me. Rather, it's shutting valves, repairing damage, and keeping salt water from the battery room. Always, the occupants must make every effort to establish communication with the outside. Not being a submarine expert, I wouldn't venture to guess what other problems might have to be solved, but I'll bet none of them would be

Add Your Figures Properly and It Comes Out All Right

Is C. S., of Baltimore, trying to kid some one with his chiseling bell-hop? I'll admit it sounds tricky at first, but if you add up your figures properly, it comes out all right. The three guests lay out \$10 apiece, or \$30, and get back \$1 apiece—total outlay \$27. Now to keep yourself straight, you've got to add the \$2 that the crooked bell-hop held out to the \$25 that the hotel retained: Total, \$27. Add to this the \$3 refund and *(Continued on page 18)*

How Big Is YOUR PAY-CHECK?

*If you earn under \$3,000,
Higher Accountancy may
be the answer for you*

THE size of my pay-check? What business is it of yours?" Perhaps that's the first reply that comes to your mind.

But—stop a moment. It really is our business—to help men just like you. In fact, it's been our business here at LaSalle for 30 years.

If your pay-check isn't all that you'd like it to be, why not consider accountancy? Why not become a member of this well-paid and respected field? Why not, in short, prepare yourself to earn real money—insure a good home for your family—a new car—an education for the growing youngsters—a bank account for a rainy day . . . these and many more of the precious things in life?

Maybe you're one of those ever hoping for "breaks" that will give you a higher standard of living. Yet that's precisely what most of 30,000,000 other employees in this country are doing.

Not all of them, of course. Here and there you find ambitious men who aren't depending on luck to carry them ahead. They're following a tested path to increased earnings—leaving nothing to mere chance. They're *training* themselves for better jobs—every week spending a few hours in serious but interesting study at home.

Some day, as expert bookkeepers and later as accountants, these determined men will have standing and a considerably larger income—in a profession that pays and pays well.

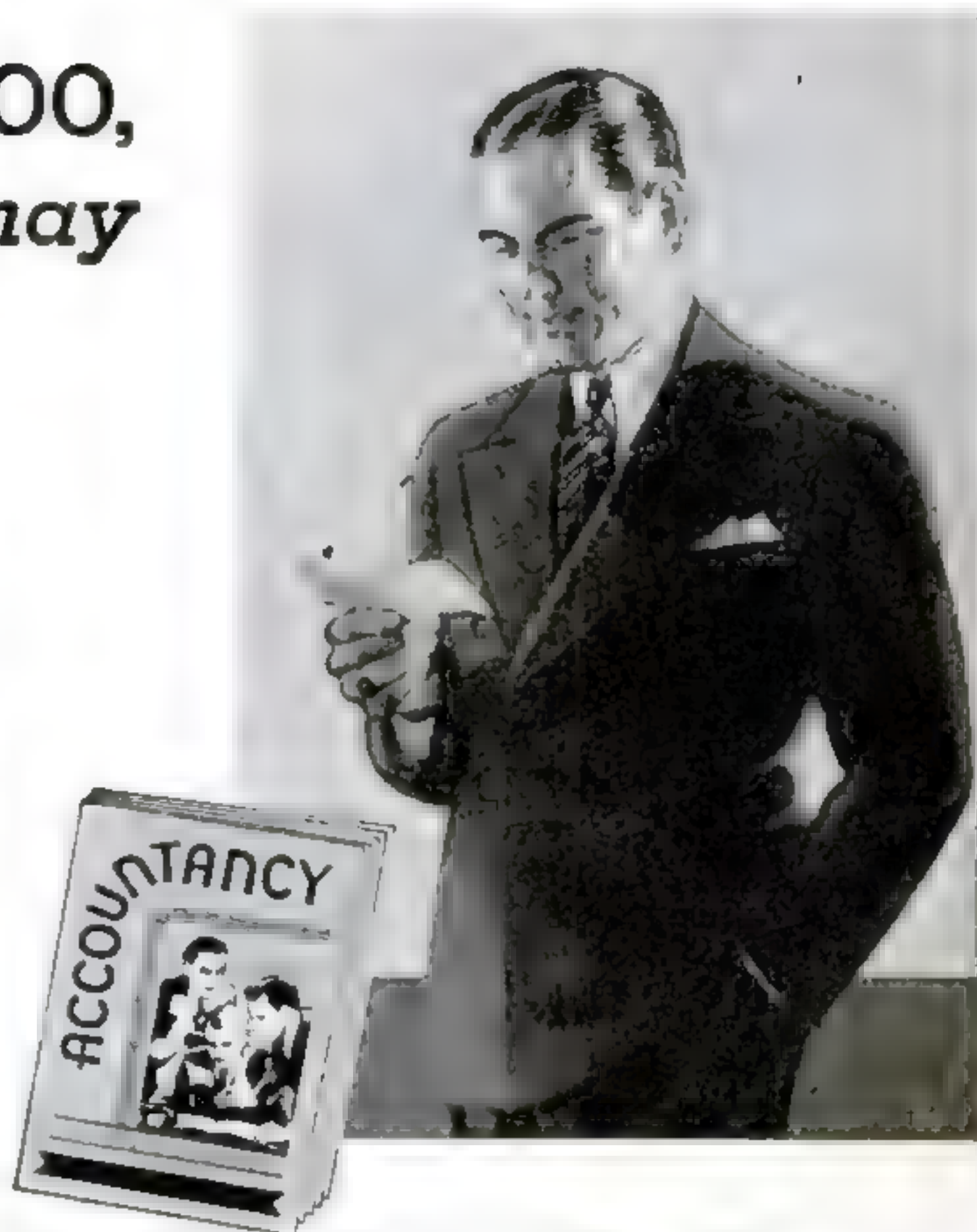
Why don't *you* do as they are doing—take advantage of LaSalle training? Even though you do not know the fundamentals of bookkeeping now—you nevertheless may have an excellent opportunity to master accountancy. Many others have done it.

Perhaps you're asking yourself, "But don't these others possess natural ability that I lack? Don't I need a special talent for all this?"

Ask rather, "If I do my part, won't I get results, too?"

You will! For all it takes is intelligence, serious study and work—not genius. Under the LaSalle system you solve problems by simple steps . . . from day to day, as an expert accountant does. You use the same basic principles. And when these problems become difficult and puzzle you, you get counsel that could be matched only through personal coaching by a battery of experts in a big accounting house.

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ing, Auditing, Cost Accounting, Business Law, Organization, Management and Finance. The training—complete and intensive all the way—takes you right into C.P.A. coaching if you desire.

Later, when you're an accountant, it may be possible to go into business for yourself as a public accountant and be independent. Or, if you choose to work for someone else as an executive accountant, it well may be for a salary several times that which you draw now.

Write for this FREE book

If you're tired of pinching pennies, investigate accountancy and LaSalle training. There isn't a faster, less expensive or more convenient method to master accountancy. Fill in the coupon and mail. We'll send you our 64-page book, "Accountancy, The Profession That Pays."

Then, when you read all the facts, you yourself will be able to judge best whether you have the will to study and apply your best efforts—toward a more secure future.

LaSalle Extension University

A Correspondence Institution

Dept. 1183-HR

Chicago, Ill.

I want to earn a bigger salary—through accountancy training. Send me, without cost or obligation, your 64-page book, "Accountancy, The Profession That Pays."

Name.....

Present Position.....Age.....

Address.....City.....

Our Readers Say (CONTINUED)

you have \$30. When I can figure them out, they are simple.—C. E. B., Hollis, N. Y.

At Any Rate, There's Been No Protest from the Rats

MAY I enter my protest against the "scientific" tests made by some Kansas City researchers who recently put some rats on a three-month binge, giving them nothing but

alcohol to drink. The experiment proved, according to the papers, that rats, like human beings, were creatures of habit and, when intemperate, were victims of headaches and other hangover complaints. My protest is against that assumption "when intemperate." Who ever heard of an intemperate rat, and what good

WHAT DO YOU MEAN
"BY ANALOGY"? A LOT
OF THEM ARE RATS!



can such tests be since rats, by all normal human rationalization, must be classed as temperate? Wouldn't it be just as logical to put humans in a cage with nothing to eat but some cheese which was carefully placed on the hair trigger of a rat trap? After a while, the humans would conceivably get so hungry that they would risk busted fingers to get at the cheese.—T. A. W., Boston, Mass.

That's Close Figuring on Anybody's Speedometer

IN REGARD to the problem submitted by D. R. C., of Sacramento, Calif., in the September issue: According to my calculations, the speed of the car must be 38.843 miles an hour.—W. L. B., Chicago, Ill.

The Psychology of Odors Interests This Bee Keeper

As a keeper of bees, I have often noted the importance of odors in the hive. Members of

the colony are recognized by their smell; interlopers are detected by their odor; the smell of the queen has a quieting and calming effect on the whole colony. I have often wondered why odors are not used oftener to produce desired psychological effects in humans. The brain was originally a smelling organ,

scientists tell us, and odors produce profound emotions over which the mind has little control. A thorough study of the question might

WELL, TEAR GAS IS
ONE USE!



provide a list of odors that could be used in theaters, churches, factories, and homes to regulate emotions and increase efficiency. In fact, "smell propaganda" might become an important feature of future wars.—A. O., Springfield, Ill.

The Hunter Better Get a Little Practice in Jumping, Himself

IN THE Ganjam District of Madras Presidency you get one of the best tiger-shooting areas in India. I was once out on foot on a shoot with a native tracker. Stalking along through the heavy undergrowth, I suddenly came face to face with a tiger. Of the two of us, I don't know which was more surprised, myself or the tiger. Before I could regain my presence of mind, the tiger sprang at me. Fortunately, he misjudged the distance and sailed clear over my head, landing about twelve feet in the rear. With a growl of disappointment, he made off into the forest. A few days later, I was out again in that part of the forest, this time with a keen look-out for Mr. Stripes. I came across a cleared space where the small bushes had been uprooted and thrown aside. My guide did not know what it all meant, so I climbed a tree at the edge of the clearing to wait developments. Half an hour later, I was surprised to see the same old tiger, that had missed getting us a few days before, stalk into the clearing and, believe it or not, what do you think he was doing? Yes, that's right, sir. He was practicing low jumps!—H. C. M. McL., Ramnad, South India.

PRACTICE MAKES
PERFECT!



Speeds of 700 Miles an Hour Are Old Stuff for Rockets

To E. F., of Atlanta, Ga., who is worried about the ultimate speed of airplanes whose propeller tips already are approaching, if not exceeding, the inefficient rate where they travel at the speed of sound, may I say you've overlooked the possibility of the rocket. I've read that the rocket is the most efficient self-propelled motor, having higher than ninety-nine-percent efficiency. Furthermore, it was a good three years ago when I first read of a rocket reaching the speed of more than 700 miles an hour. Now I'd like to read some up-to-date news in P.S.M. on what is being done in experimental rockets at the present time. Incidentally, since rocket motors are so extremely efficient, why can't they be used to propel airplanes, in place of the highly inefficient gasoline motors now in use?—W. B. N., Louisville, Ky.



**-but...
have you
connected
them with
*Your Future?***

HAVE YOU GIVEN THE DIESEL
FIELD ANY REAL THOUGHT?

You have seen the full page newspaper and magazine ads on new type Diesels. You have read frequent news items on the rapid, ever-expanding adoption of Diesel power. You have seen many magazine articles on the spectacular growth of the Diesel industry. But have you connected any of them with your own future?

Investigate for yourself . . . get your free copy of the pictorial "March of Diesel" . . . find out about Hemphill Diesel training. You can start right at home and finish in the Hemphill Schools shops. Send the coupon NOW.

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Please send data on your Diesel courses, also free copy of illustrated booklet "March of Diesel."

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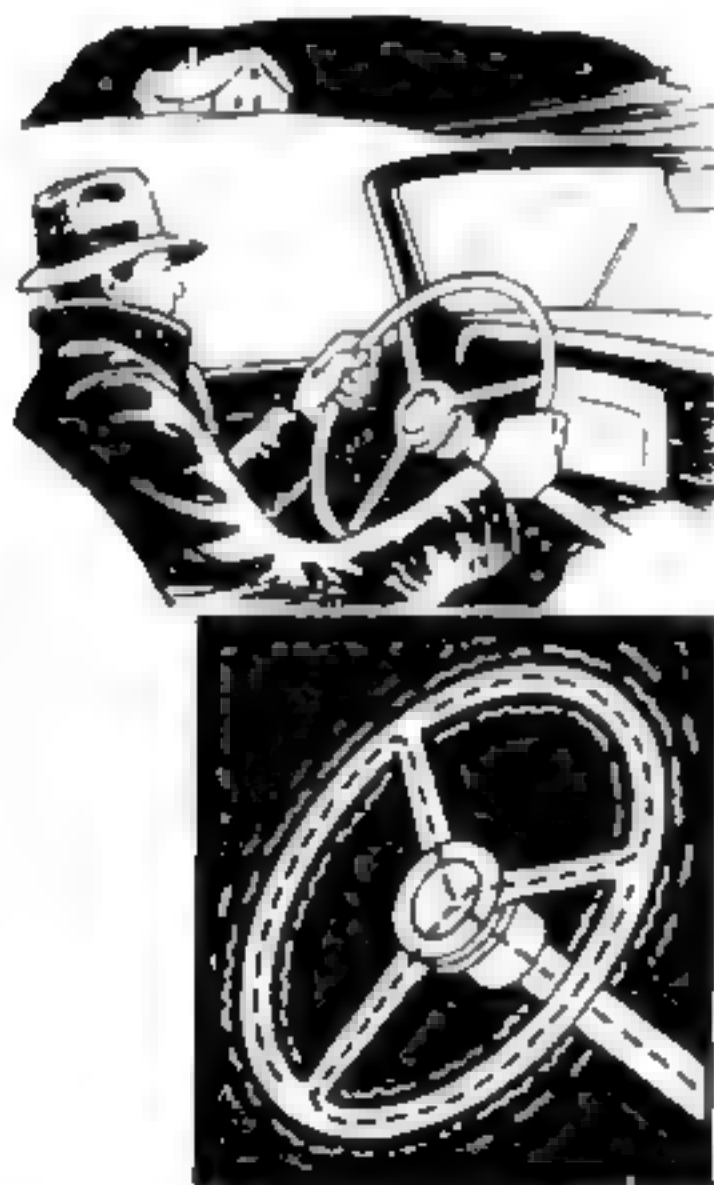
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With the Inventors

A BOON to bandsmen who play outdoors in shivery weather during midwinter parades or at late-fall football games is a novel muff invented by Duane F. Rupert, of Gloversville, N. Y. Made with a durable waterproof covering of hide and lined with fleece or fur, the muff has a slide fastener



to make it easy to slip on or off an instrument such as a clarinet. Openings in the muff allow the musician's hands to finger the keys or holes of the instrument, while fully protected from the cold. The inventor claims that the muff will also prevent the condensation of water within the instrument and help preserve correct pitch, which is often disturbed in cold weather . . . IT IS ESTIMATED that of every three lawsuits concerning patents, only one ever reaches a final decision in the courts, the two others being dropped by one side or the other, or settled amicably out of court . . . LOUISE B. PREBLE, of Hingham, Mass., proposes another bright idea for cold weather:



An automobile steering wheel that is electrically heated. Especially useful for drivers of open trucks or cars, the wheel has internal channels that carry resistance wires. These heating elements are connected to the car battery through the wheel spokes and the steering column . . .

DURING THE LAST FORTY YEARS, an average of about twenty of every 100 patents issued in the United States have been in some way related to automobiles or the automotive industry . . . "WRITE IT ON THE CUFF" becomes something more than a slang phrase with the

development by Raymond E. Kinney, of Topeka, Kans., of a wrist-strap note pad. Installed in a case very similar to that of a wrist watch, rollers carry a narrow strip of paper on which notes and memoranda can be written in the space normally occupied by the dial of a wrist watch. Moving knobs on the outside of the casing turns the rollers to provide a fresh paper surface at any time, or to move previously written notes back into view . . . THE INCREASING COM-



PLEXITY of many chemical patents is well illustrated by patent 2,163,607. It has seventeen claims, the first of which is broken up into twenty-nine distinct subdivisions . . . TO MAKE THE DRIVER of a taxicab that uses a meter hold to a true accounting of his fares, and prevent him from giving free rides, a new gear-shift control devised by Joseph Lad-daga, of New York City, makes it impossible for the driver to shift into high gear unless the rear passenger seat is occupied and the meter operating. When a customer sits down on the rear seat, his weight automatically actuates a hydraulic control that releases a gearshift locking device, and at the same time sets the cab's fare meter in operation. To shift his position in the waiting taxi line, or for other



short car movements, the taxi driver can proceed in reverse or in a low gear at any time . . . THE U. S. COURTS have ruled that if one person suggests an invention to another, without giving him any explanation of how it can be put into effect, the latter can apply for a patent if he puts the

(Continued on page 22)

PATENT and MARKET YOUR INVENTION

How
**SUCCESSFUL
INVENTORS DO IT!**

This
**FREE
BOOK
TELLS HOW**

IF there is a reliable formula followed by successful inventors, it is (1) a good invention, (2) a good patent, (3) a good market. To make the formula work, in this modern age of competition, point No. 2, effective patent protection, is the real connecting link between companion points No. 1 and 3.

NATION-WIDE MERCHANDISING SELLS NEW PRODUCTS BY THOU- SANDS

Many times inventors say, "It's such a simple gadget—is it worth a patent?" Inventors who say this have little conception of modern merchandising methods. New gadgets are not "peddled" today from town to town. Mass production takes them over and turns them out immediately on a big scale. Nation-wide sales agencies put them quickly in stores all over the country. If a manufacturer takes your invention the wheels of mass production start rolling and—almost overnight—the new commodity or novelty is "on sale" from coast to coast. That's the modern American way. New production methods, salesmanship, advertising and promotion do not wait for public demand—they create it! Modern business makes pennies of royalty pile quickly into dollars of profit—profit that must be protected by worthwhile patent.

BE SURE TO PROTECT YOUR RIGHTS

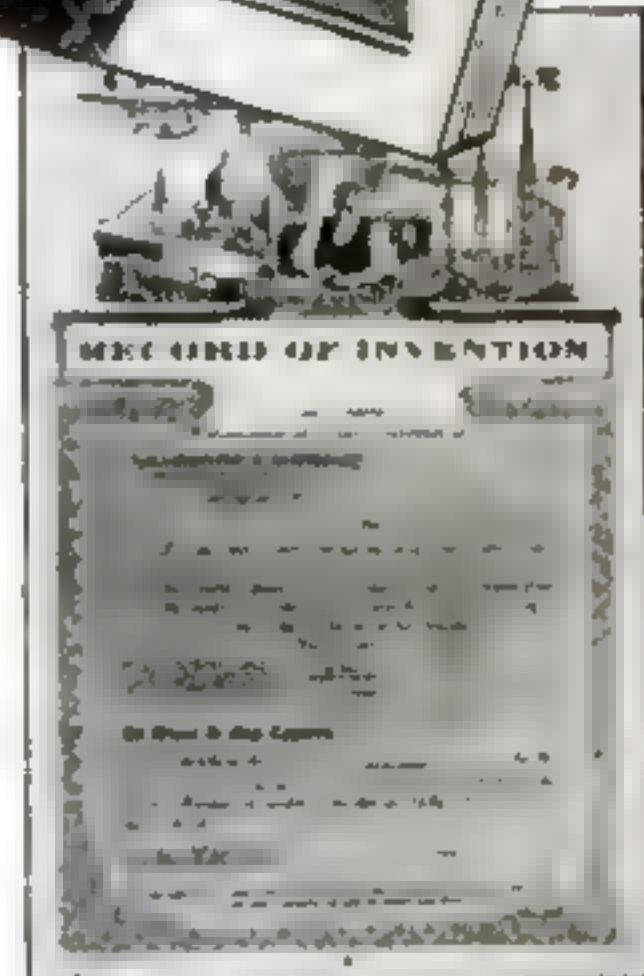
The U. S. A. is the greatest open market for new inventions in the world. Here commercial striving is so keen that the unprotected invention, if it has public acceptance, is quickly "eyed" and may become the prey of eager competition. Worthwhile manufacturers won't bear the production costs and sales expense of promoting a new invention unprotected by patent. A good, strong patent not only opens the road to marketing your invention, but closes it to would-be chiselers who may seek to reap the rewards of your creative efforts.

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During the past twenty years we have helped great numbers of inventors secure their U. S. Patents. We know the pitfalls and how to avoid them. We have trained, experienced patent draftsmen and registered patent attorneys ready to serve you—and each one, when he undertakes to handle your case, realizes that he is personally responsible to contribute the fullest individual effort possible.

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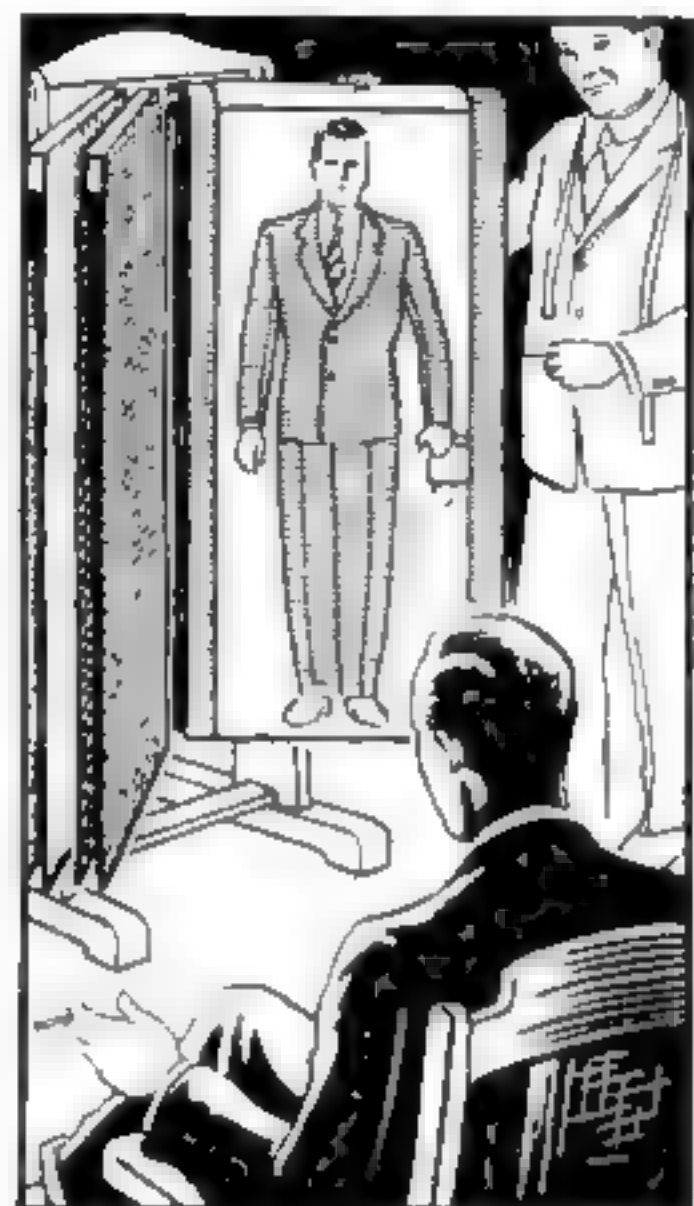
sketch and description of your invention, and \$5.00. I will make a search and report promptly as to its patentability and send you a copy of my 72-page booklet. Or, if you prefer to read my booklet first, write today for FREE copy. Registered Patent Attorney.

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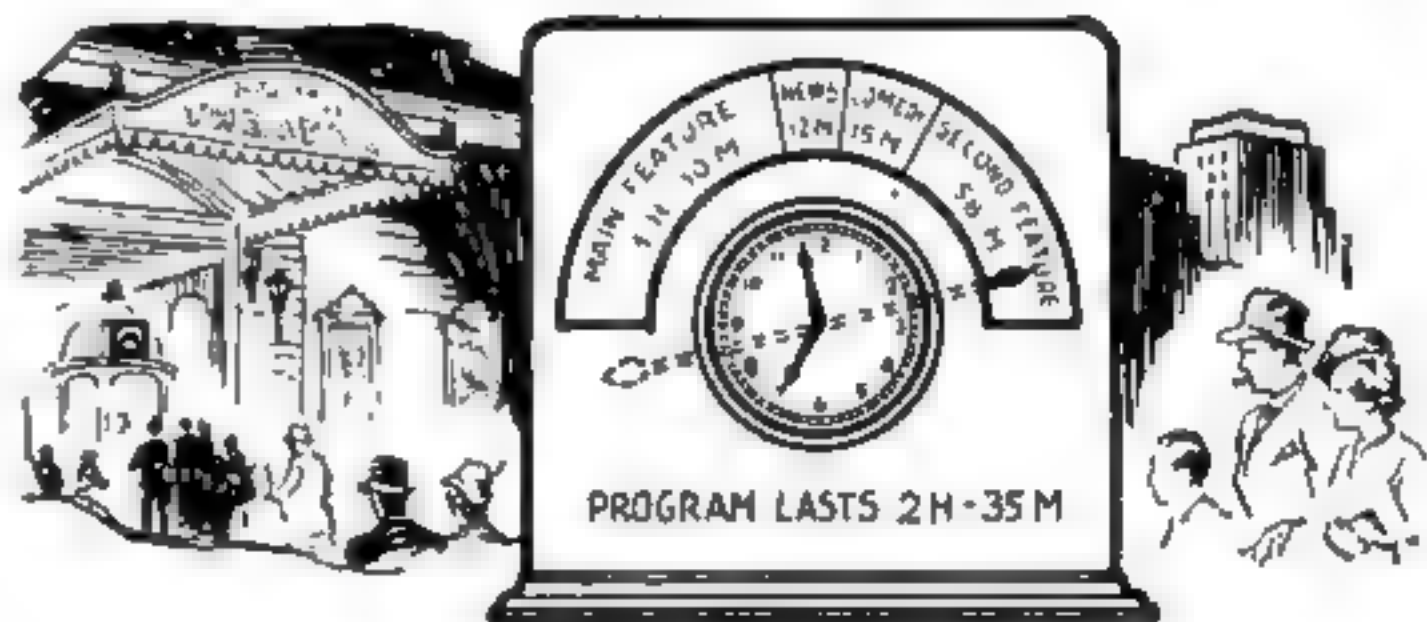
With the Inventors

(Continued from page 20)

idea into practicable shape . . . TO SHOW CLOTHING FABRICS to customers in a way that will help them visualize how the material will look in a finished suit or overcoat, Lee L. Levering, of Tulsa, Okla., devised a novel system for fabric display racks used in clothing stores and tailor shops. A sample of clothing material is draped over a hinged arm of the display rack. A salesman then places against it a panel of transparent material on which is drawn the outline of a suit of



clothes on a human figure. Most of the transparent panel has been made opaque so that the underlying fabric shows through just the outlined clothed section of the figure, thus providing the customer with a view of how the fabric will look made up into a finished garment . . . IN AN ARGUMENT over the rights to a trade-mark of a product or invention between the person who first thought of the name and the person who first used it commercially, the law practically always favors the latter . . . DESIGNED ESPECIALLY for use in movie-theater lobbies, an indicator invented by Leonard McGihon, of San Leandro, Calif., shows just what portion of the theater's program is in progress at any given time, ap-



proximately how long this feature will last, and when it will be over. The various parts of the program—feature pictures, news, shorts, and stage show—are marked on a semicircular dial, each taking space in proportion to the time it occupies during the course of one complete program. Moving

(Continued on page 24)



SUDDEN DEATH

gave birth to A NEW IDEA

In 1880, in the region around Scranton, Pennsylvania, coal was king—and death his grinning jester!

In dark mine passages, men died of ignorance . . . ignorance of modern safety measures. Appeals for life-saving information poured in to a local newspaper, and were answered. Men lived, who might have died.

Out of this situation grew one of mankind's rarest achievements . . . a new idea . . . the idea that when ambitious men demand vital training, yet are unable to go to school, a school must go to them!

For 49 years, the International Correspondence Schools (with headquarters at Scranton) have been offering ambitious men sound, essential training in technical and business subjects. More than four million men have been enrolled in these world-famous Schools. Thousands of business and industrial leaders acknowledge the part I.C.S. training played in their success.

Your lack of training may not kill you, as it killed so many miners. *But it will kill your chances of success!* Mail the coupon now—and learn how you can become a trained man, getting a trained man's pay!

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Without cost or obligation, please furnish me with full particulars about the subject *before* which I have marked X:

TECHNICAL AND INDUSTRIAL SUBJECTS

- | | | | |
|---|---|--|--|
| <input type="checkbox"/> Air Conditioning and Cooling | <input type="checkbox"/> Diesel Engineering | <input type="checkbox"/> Radio | <input type="checkbox"/> Refrigeration |
| <input type="checkbox"/> Architectural Drafting | <input type="checkbox"/> Electrical Engineering | <input type="checkbox"/> Sanitary Engineering | |
| <input type="checkbox"/> Architecture | <input type="checkbox"/> Electric Lighting | <input type="checkbox"/> Sheet Metal Work | |
| <input type="checkbox"/> Auto Elec. Technician | <input type="checkbox"/> Fire Boilers | <input type="checkbox"/> Steam Elec. Eng'ring | |
| <input type="checkbox"/> Auto Technician | <input type="checkbox"/> Foremanship | <input type="checkbox"/> Steam Engineering | |
| <input type="checkbox"/> Aviation | <input type="checkbox"/> Heating | <input type="checkbox"/> Steam Fitting | |
| <input type="checkbox"/> Boilermaking | <input type="checkbox"/> Heat Treatment of Metals | <input type="checkbox"/> Structural Drafting | |
| <input type="checkbox"/> Bridge Engineering | <input type="checkbox"/> Highway Engineering | <input type="checkbox"/> Structural Engineering | |
| <input type="checkbox"/> Building Estimating | <input type="checkbox"/> House Planning | <input type="checkbox"/> Surveying & Mapping | |
| <input type="checkbox"/> Chemistry | <input type="checkbox"/> Machinist | <input type="checkbox"/> Telegraph Engineering | |
| <input type="checkbox"/> Civil Engineering | <input type="checkbox"/> Mechanical Drafting | <input type="checkbox"/> Telephone Work | |
| <input type="checkbox"/> Coal Mining | <input type="checkbox"/> Mechanical Eng'ring | <input type="checkbox"/> Toolmaking | |
| <input type="checkbox"/> Contracting and Building | <input type="checkbox"/> Patternmaking | <input type="checkbox"/> Ventilation | |
| <input type="checkbox"/> Cotton Manufacturing | <input type="checkbox"/> Plumbing | <input type="checkbox"/> Welding, Electric and Gas | |
| | <input type="checkbox"/> Public Works Eng'ring | <input type="checkbox"/> Woolen Manufacturing | |

BUSINESS SUBJECTS

- | | | |
|--|--|---|
| <input type="checkbox"/> Accounting | <input type="checkbox"/> Civil Service | <input type="checkbox"/> High School Subjects |
| <input type="checkbox"/> Advertising | <input type="checkbox"/> College Preparatory | <input type="checkbox"/> Managing Men at Work |
| <input type="checkbox"/> Bookkeeping | <input type="checkbox"/> Cost Accounting | <input type="checkbox"/> Salesmanship |
| <input type="checkbox"/> Business | <input type="checkbox"/> C. P. Accounting | <input type="checkbox"/> Spanish |
| <input type="checkbox"/> Correspondence | <input type="checkbox"/> First Yr. Col. Subjects | <input type="checkbox"/> Secretarial Work |
| <input type="checkbox"/> Business Management | <input type="checkbox"/> French | <input type="checkbox"/> Stenog. and Typing |
| | | <input type="checkbox"/> Traffic Management |

DOMESTIC SCIENCE SUBJECTS

- | | | |
|---|---|--|
| <input type="checkbox"/> Advanced Dressmaking | <input type="checkbox"/> Professional Dressmaking and Designing | <input type="checkbox"/> Tea Room and Cafeteria Management, Catering |
| <input type="checkbox"/> Foods and Cookery | | |
| <input type="checkbox"/> Home Dressmaking | | |

Name.....Age.....

Address.....

City.....State.....

Present Position

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BATTERY MIRACLE

1. WATER ONLY
THREE TIMES
A YEAR

2. 51 BIG
POWER PLATES

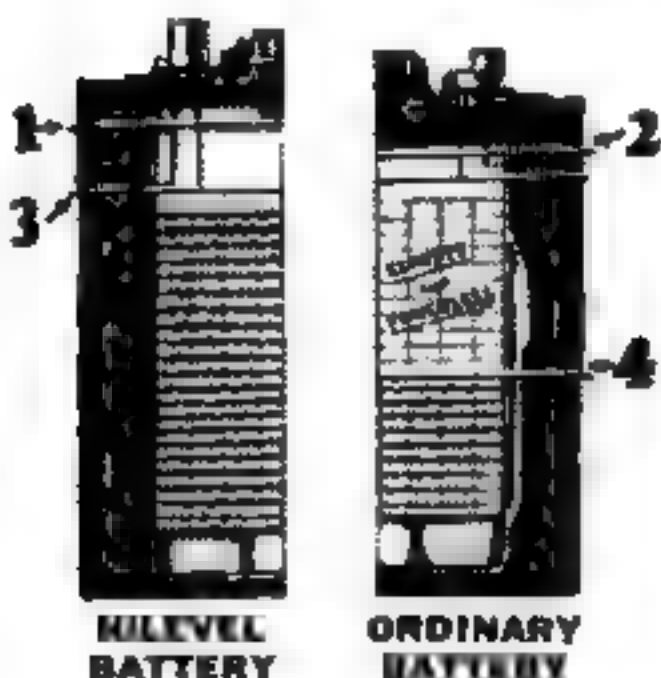
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WHAT a battery—and what a PRICE! Fiberglas insulation! 51 big powerful plates! Rugged construction that means no power leakage! Plenty of punch for winter starts! All these features, PLUS the Prest-O-Lite HiLevel principle that makes it necessary to water this battery only 3 times a year under normal usage. See your Prest-O-Lite dealer NOW—save time and money with this new Prest-O-Lite SILVER JUBILEE Battery.

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HOW HiLEVEL FEATURE WORKS

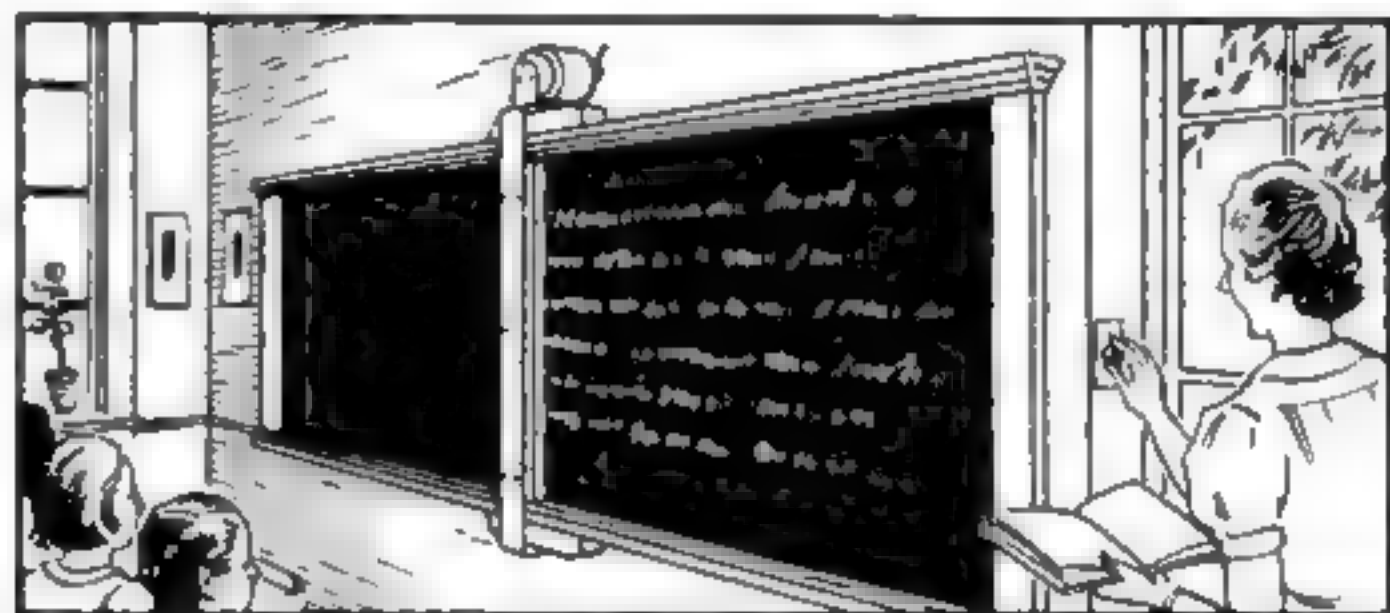
- ① FILLING LEVEL of Hi-Level Battery. (Note extra height.)
- ② FILLING LEVEL of ordinary battery.
- ③ By the time the fluid in a HiLevel Battery drops to here, (note plates are still covered)...
- ④ ...in an ordinary battery it falls to here, leaving a large part of the plate surface exposed and powerless.



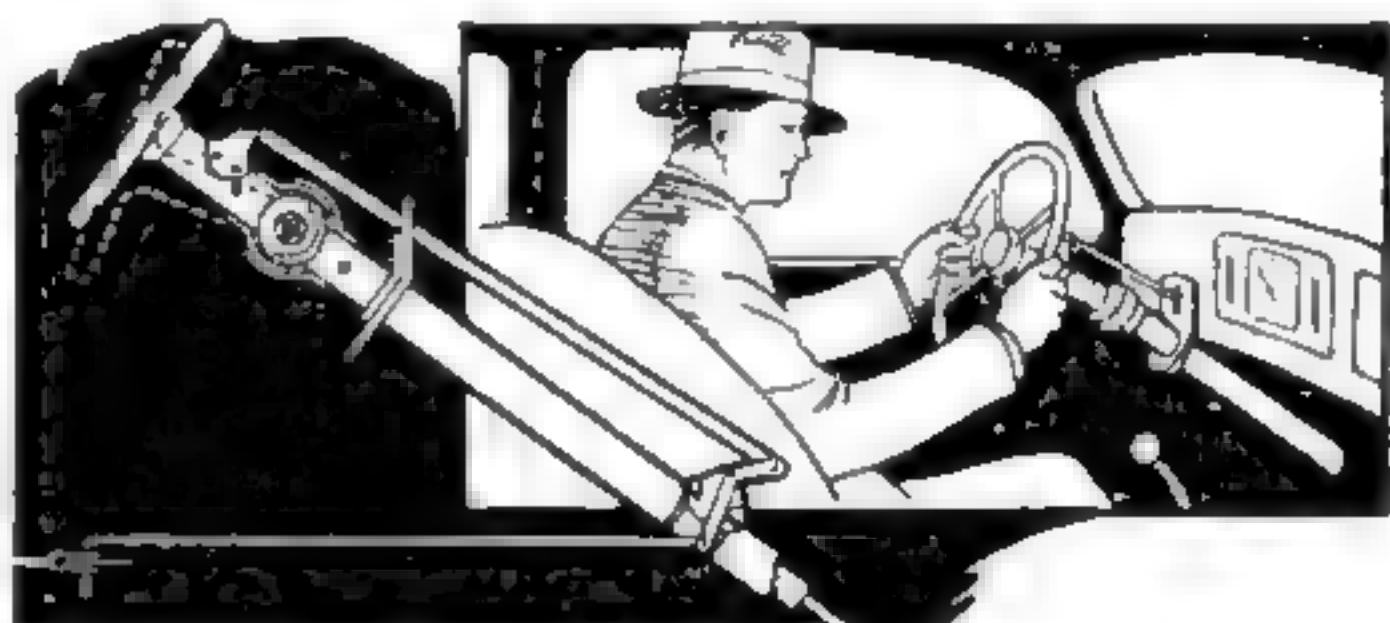
With the Inventors

(Continued from page 22)

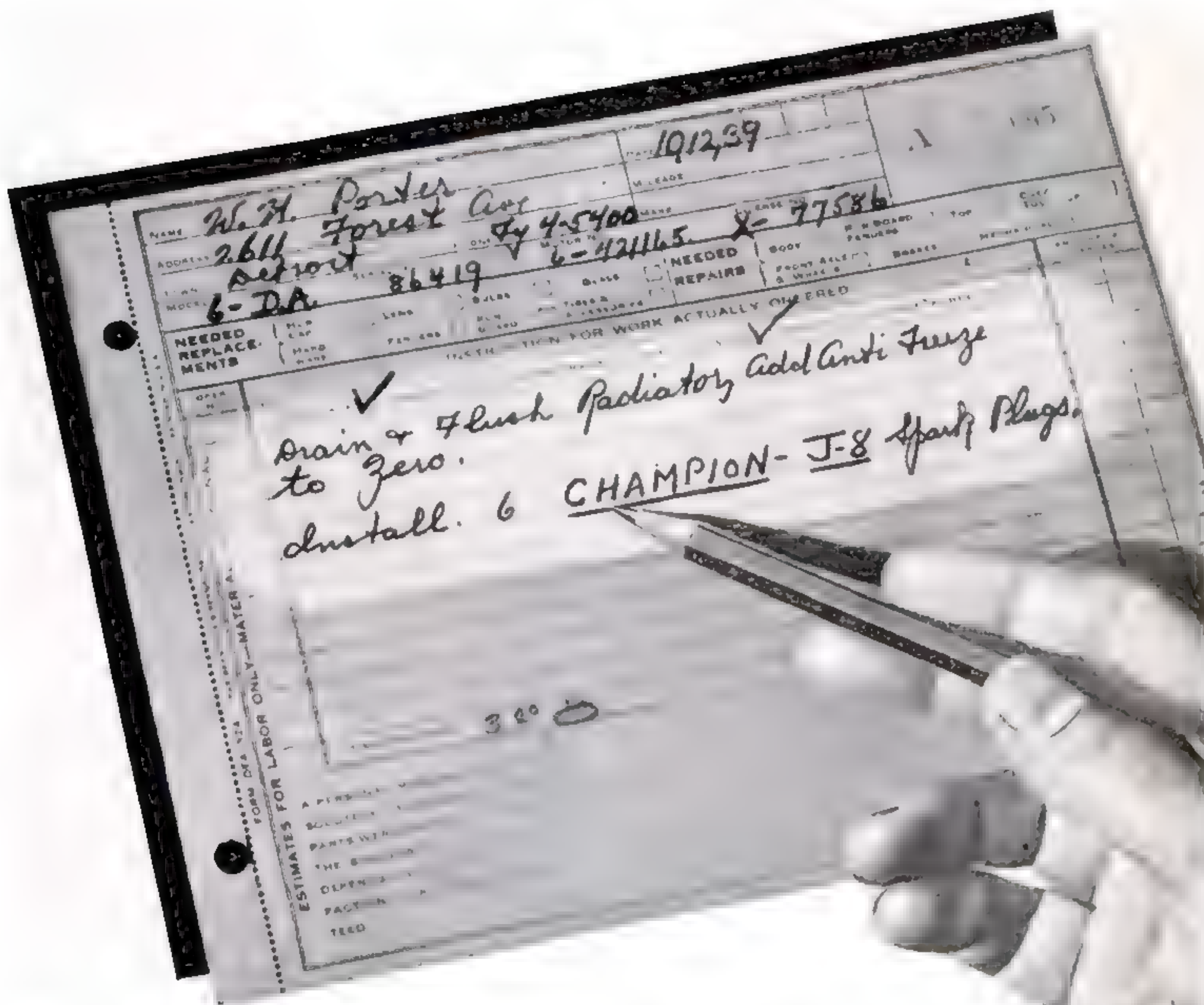
along this dial is a pointer operated by a special clock mechanism. A quick glance at this pointer will enable the theater cashier, doorman, or usher to answer immediately a patron's question on the progress or remaining duration of any feature in the show . . . WIPING CHALKED WORDS



AND FIGURES from blackboards is no longer a chore for students or teachers when the blackboards are equipped with an automatic eraser developed by Gordon C. Farmer, of Richlands, Va. When a switch is flipped, an electric motor running horizontally along a track at the top of the blackboard moves a slender vertical erasing arm that extends from the top to the bottom of the board. The motor-driven contrivance moves from its starting point to the opposite side of the blackboard where the switch is tripped by engagement of its arm with a projecting stop, reversing the mechanism, which then travels back across the board to its starting point . . . AN AUTOMOBILE STEERING WHEEL invented by Walter W. Gilbert, of Stillwater, Minn., controls the brakes of a car as well as the steering. The upper section of the steering column is pivoted so that the wheel may be moved up or down as well as turned in the



normal fashion. Controls leading to the car's brake system are attached to the column in such a way that when the wheel is moved downward toward the floor of the car, the brakes are applied. The wheel remains effective for steering regardless of the setting of the brakes, as the steering column contains a universal joint.



Cold Weather and Hard Starting

Hold No Fears for Mr. Porter

It is the simple, inexpensive and well-rewarded practice of thousands of motorists to protect their cars against hard starting by installing new sets of Champion Spark Plugs just before cold weather sets in.

The advantages of installing new Champions *now* are manifold, and quickly apparent to the driver. They insure quick starting in coldest weather; they forestall heavy drain on the battery occasioned by hard starting; they also minimize the dangers from crankcase dilution due to excessive use of the choke—automatic or manual—which is

usual in cold weather starting and through the warming up period.

Thus it will be seen that a new set of Champion Spark Plugs is cheap insurance against temper-trying delays and needless expense. Furthermore, the savings in gas and oil quickly pay for the cost of a new set of Champions.

Insist on Champions by name, to be sure that you get the spark plugs champions use. Dependable dealers everywhere sell dependable Champions.

CHAMPION

SPARK PLUGS

IT'S THRIFTY TO INSTALL NEW SPARK PLUGS — Demand CHAMPIONS

**DANGER
GO SLOW**

WHEN

*Read
This*

THERE'S no other product like "Prestone" anti-freeze. It contains NO alcohol... NO glycerine. It's made with highly refined and purified ethylene glycol. But it took far more than ethylene glycol to make "Prestone" brand anti-freeze the world's finest winter protection!

In "Prestone" anti-freeze, ethylene glycol is fortified with *exclusive* ingredients developed after years of laboratory research and millions of miles of the toughest test driving an anti-freeze can undergo. These ingredients curb leaking, foaming, rust clogging.

It takes years of experience to make a great anti-freeze. Beware of new and untried preparations.

And think twice before you spend even a dollar for a gallon of alcohol base anti-freeze. (Regardless of brand name dollar-a-gallon anti-freezes usually contain alcohol.) Alcohol boils away... has to be replaced. "Prestone" anti-freeze will not boil away. One filling lasts all winter long.

Remember: "Prestone" anti-freeze has proved itself in more cars than any other brand of anti-freeze ever made!

GUARANTEE

"National Carbon Company, Inc. specifically guarantees that 'Prestone' brand anti-freeze, if used according to printed directions, in normal water cooling systems, will protect the cooling system of your car against freezing and clogging from rust formations for a full winter, also that it will not boil away, will not cause damage to car finish, or to the metal or rubber parts of the cooling system, and that it will not leak out of a cooling system if it's enough to hold water."

This famous "Prestone" anti-freeze guarantee says plenty and says it in writing for your protection. That's another big reason for the popularity of "Prestone" anti-freeze.

**NEW
LOW
PRICE** **\$2.65** per gal.

GOOD NEWS—"Prestone" anti-freeze is now sold at only \$2.65 per gallon—the lowest price in history! See your "Prestone" anti-freeze dealer today. He'll protect your car as specified by the official chart. Then smile with "Prestone" anti-freeze... let others boil!



The words "Prestone" and "Eveready" are registered trademarks and identify products of National Carbon Co., Inc.

GET PRESTONE ANTI-FREEZE...

YOU BUY AN ANTI-FREEZE!

*Avoid
This*



"PRESTONE" ANTI-FREEZE will never fail you no matter how long or cold the winter. When you put it into your car you can forget about costly freeze-ups. There's no replacing. You're safe!



MANY ANTI-FREEZES are made with alcohol. But their brand names don't say so. These anti-freezes may hold away, require replacing. Prestone's anti-freeze is not made with alcohol. Does not hold oil.

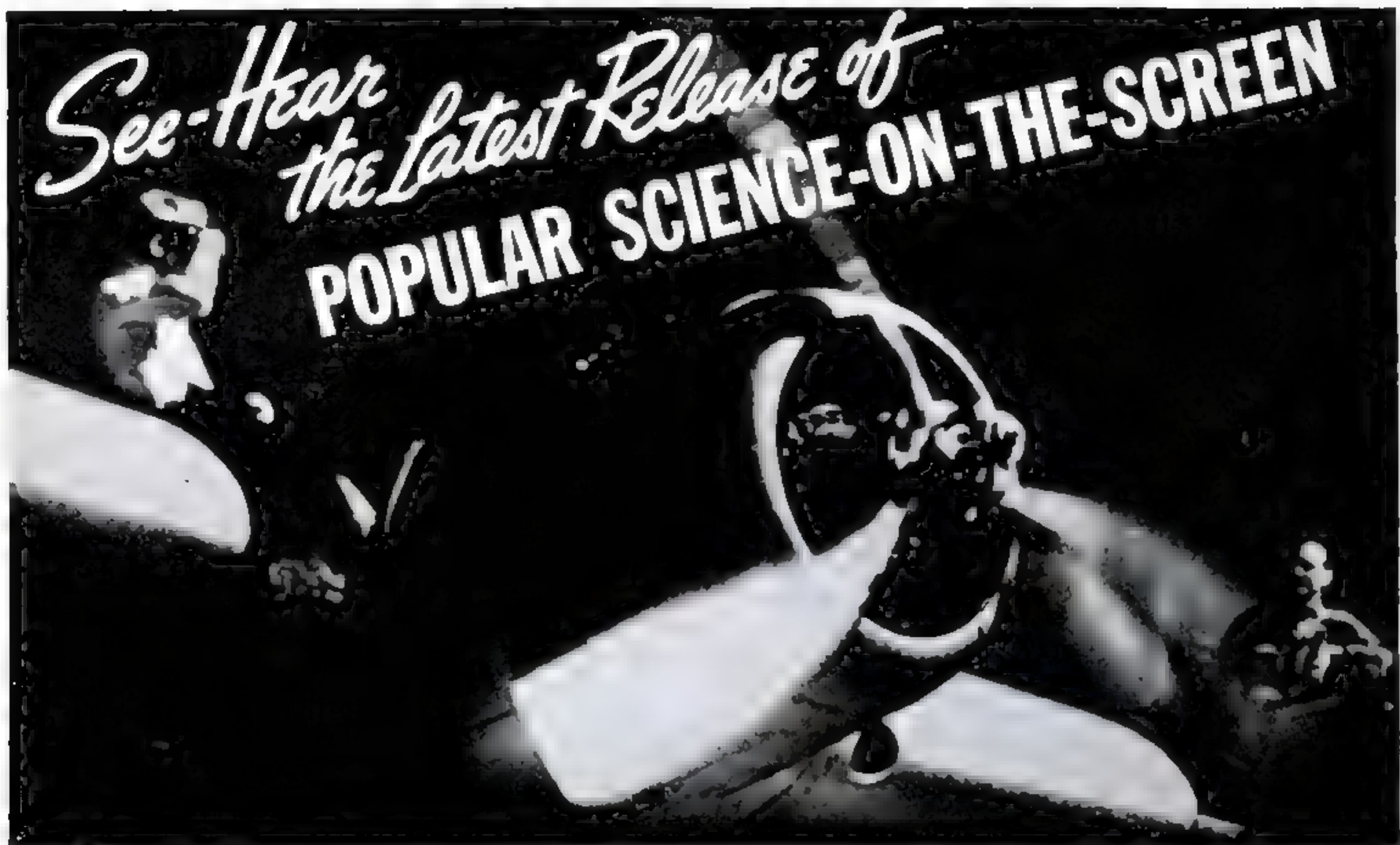


"PRESTONE" ANTI-FREEZE ends all your worries about rust. It protects your car from rust-clogging that chokes up the cooling system... causes overheating. And "Prestone" anti-freeze does not foam.



NO DANGEROUS FUMES from "Prestone" anti-freeze—no fire-hazard. "Prestone" anti-freeze cannot harm car finish or the metal and rubber parts of your cooling system. Absolutely odorless!

AND FORGET WINTER WORRIES!



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FOR TRANS-OCEANIC FLIGHTS!**



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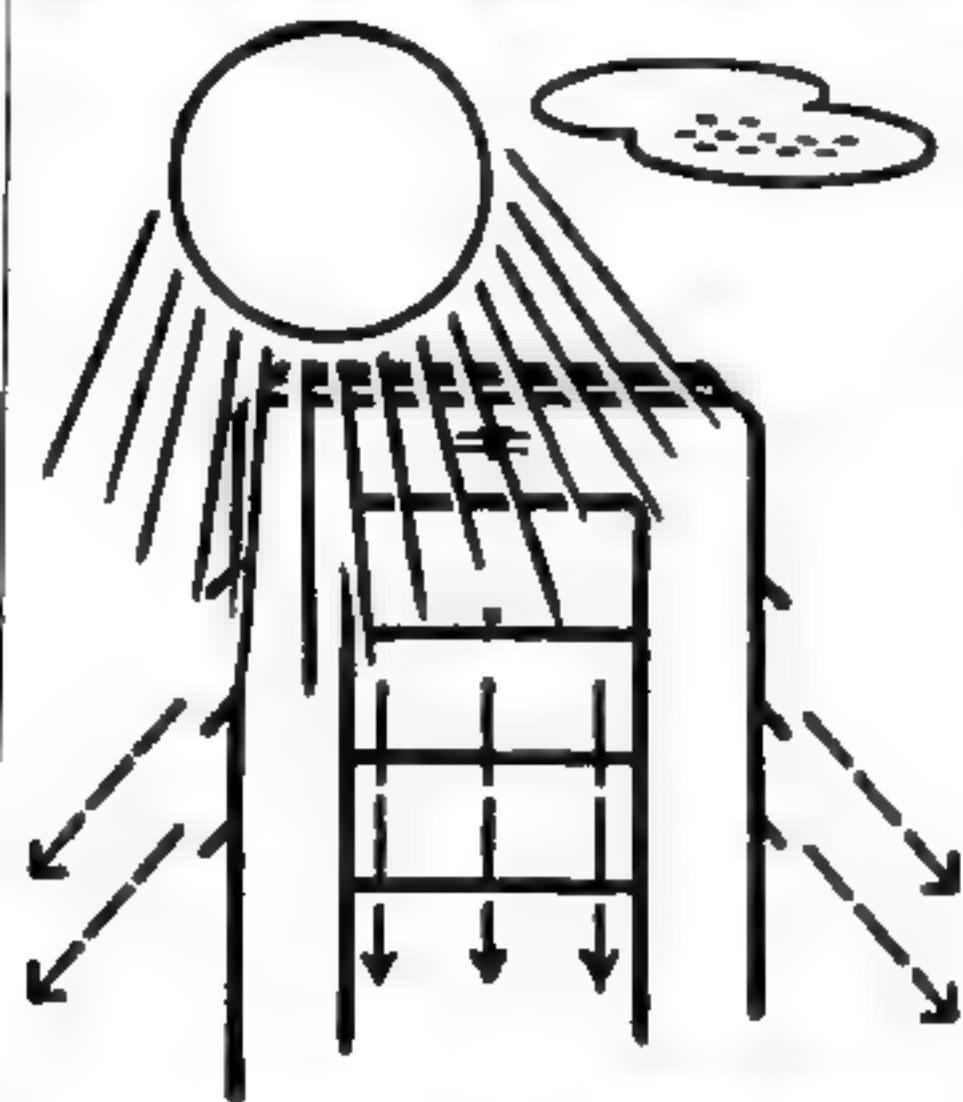
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SUPERFEX Oil Heater's exclusive patented feature "bends" nature to science . . . gives living zone comfort.*

Engineers "scored one on nature" in developing SUPERFEX Heater's extra-comfort advantage. Radiant heat rays—like sun rays—heat anything they strike. But

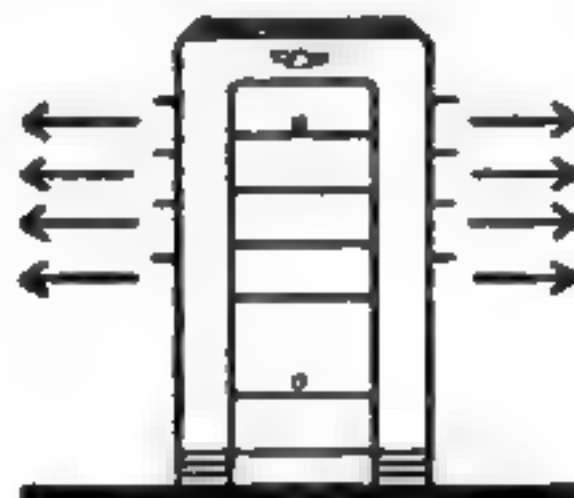
radiant heat rays from SUPERFEX are *controlled* by adjustable shutters—deflected *outward* and *downward* at will—bringing *extra* comfort to anyone in the living zone.*



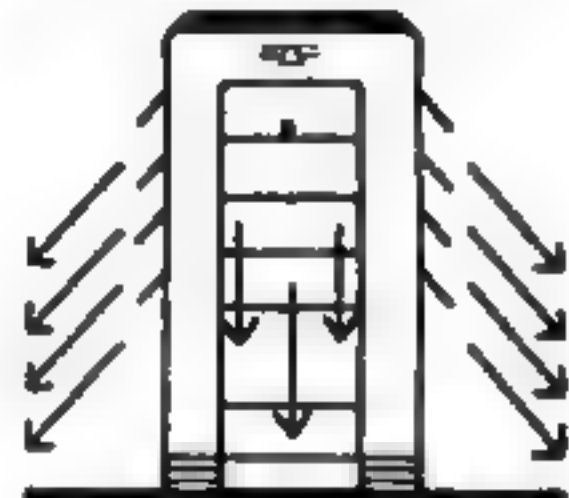
1. SUPERFEX circulates comfortable, warmed air—one type of heat—like this.



2. SUPERFEX's patented shutters, wide open, release a flood of cozy, radiant heat rays—a different type of heat—outward like this.



3. And they also direct these radiant heat rays downward to eliminate cold, drafty floors, insuring comfort everywhere.



SUPERFEX gives *extra* comfort without extra cost. Its patented shutters *direct* radiant heat rays; it needs no fans or blowers that increase operating expense and cause uncomfortable floor drafts. And only SUPERFEX has these patented shutters!

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variety of inexpensive fuel oils available everywhere. SUPERFEX brings a new sense of comfort to homes, stores, filling stations, etc. Complete line in both Heat-Director and Radiant models with removable fuel reservoir. Also available with constant level valve for use with outside fuel supply. Easy purchase plan. See your dealer. FREE descriptive booklet—just send coupon.

*The living zone is the lower half of your rooms—where you live—the space where you especially need heat.

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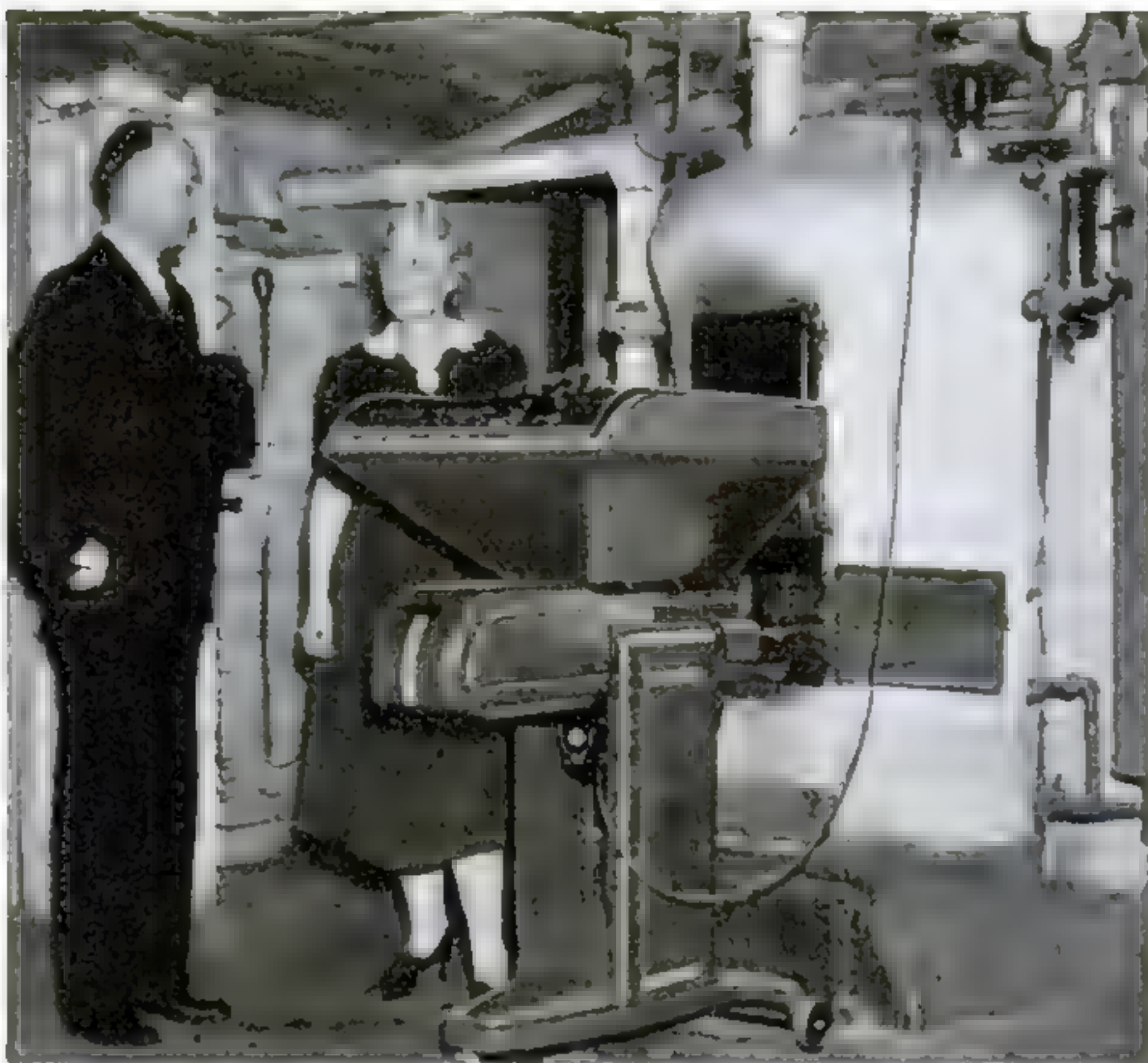
Street or R. F. D. P. O.

County State

New Ideas for Home Owners

Electric Stoker Rolls up to Bin To Be Refilled

SAID to be practically trouble-free, an electrically operated coal stoker for home furnaces requires no installation expense and can be mounted without even putting out the existing furnace fire. Quiet in operation, the stoker has only four moving parts, will fit all types of furnaces, and will feed coke, hard coal, or soft coal. Mounted on wheels, it can be pushed from the furnace to the coal bin for filling, and then rolled back into place. Thermostat or damper controls enable the stoker to maintain an even house temperature.



Wheeled up to a furnace's open door, the stoker works automatically



Even if the shade is rolled up crooked, it will not bind against these offset brackets

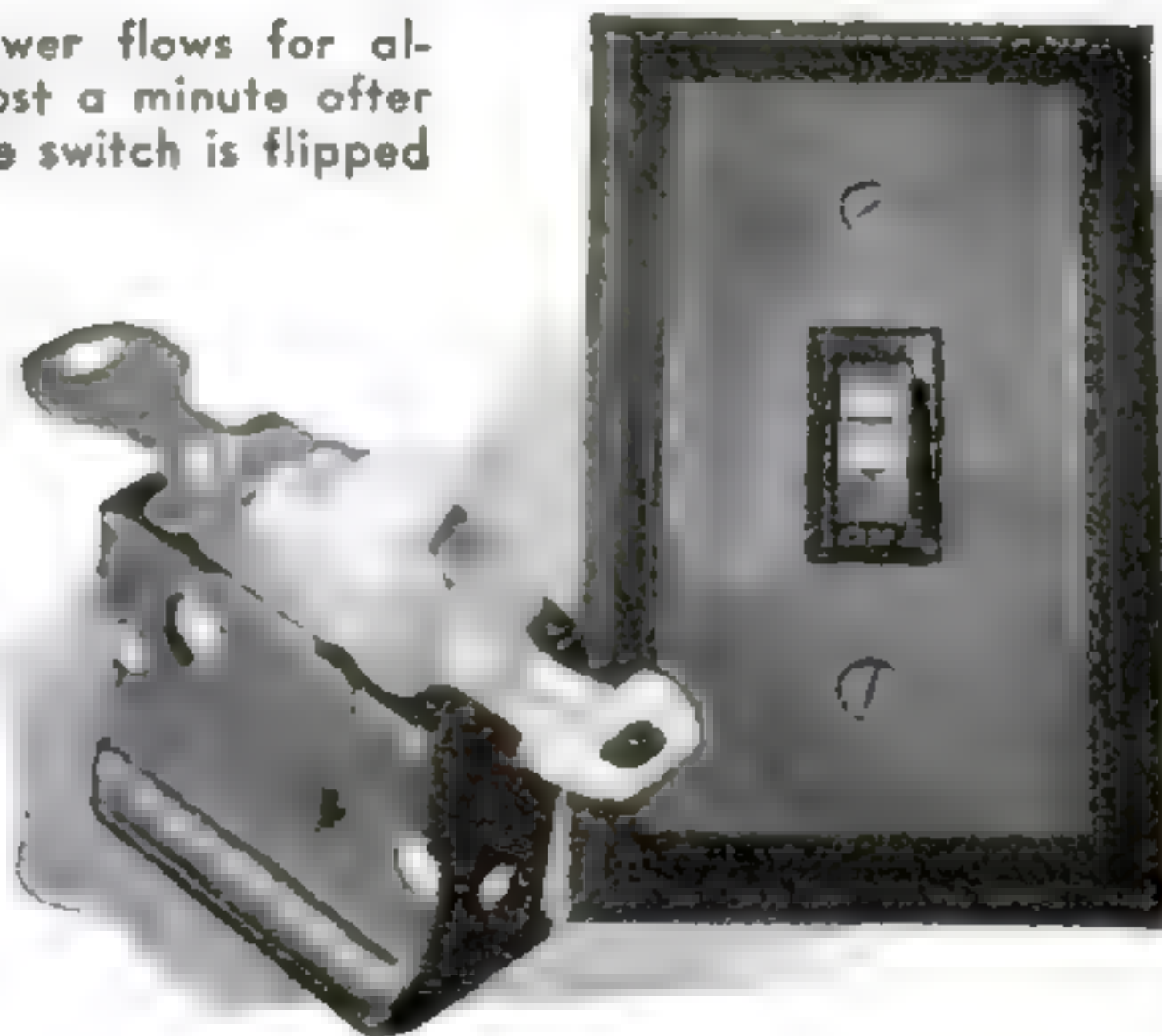
Roller-Shade Brackets Protect Fabric Edges

WITH considerable usage, window shades are liable to have their edges torn and ripped by contact with sharp brackets that hold the rollers in place. An improved bracket now on the market is offset to prevent contact between the shade edges and the brackets, as shown in the photograph above. Even when the shade is rolled up crooked, its edges are not likely to be injured by the bracket since the inside surface of the latter is curved outward.

New Lighting Switch Has Delayed Action

HOME OWNERS will not have to grope through darkened rooms after they turn the lights off when they have a new delayed-action wall-type switch which allows the lights it controls to stay on for from twenty to sixty seconds after the toggle is snapped. The switch may be used with lights rated from forty to 250 watts.

Power flows for almost a minute after the switch is flipped





Attention PIPE SMOKERS

THINK OF THE TOBACCO YOU ARE NOW WASTING—you are actually smoking only 2/3 of the tobacco you buy—only 10c worth out of a 15c package—

with your present pipe you actually smoke only this much of the tobacco you pay for—
and you waste this much.



YOU CAN STOP THIS WASTE with the Briar Hill. **YOU SMOKE ALL OF YOUR TOBACCO**—and **YOUR PIPE STAYS LIT**. Briar Hill Stokers give you "a one match smoke."

Good to the last puff—the mild smoothness will surprise you. You get a dry cool smoke—no slugs—no soggy heel.

No more finger pushing to keep the fire against the tobacco—the stoker packs the tobacco up and burns it at the top of your pipe.

Your present pipe is a furnace—the fire heats the side walls. In a Briar Hill, the fire is at the top of the bowl. It stays lit and your pipe stays cool. A cool pipe means a cool smoke.

You don't have to cake your pipe—it's mild and sweet from the first.

You get **MORE PUFFS TO THE PIPEFUL** . . . every puff dry, cool, sweet and velvety.

You are now *wasting* one-third of the tobacco you buy simply because that "lower one-third" in each pipeful gets wet, soggy and unfit for smoking.

A "BRIAR HILL" STOKER in your pipe will change all this—you will smoke **ALL** of the tobacco on **ONE MATCH**—and enjoy the longest, sweetest smoke you ever had from any pipe.

With the "BRIAR HILL" underfeed STOKER you raise the tobacco as you smoke—keep the fire at the top of the bowl where *only cool fresh air is taken in* (no pre-heated air as in the conventional pipe after it is one-third smoked). The tobacco will stay lit without overheating your pipe and the result is a *slow smoke, cool, sweet and dry, GOOD TO THE LAST PUFF.*

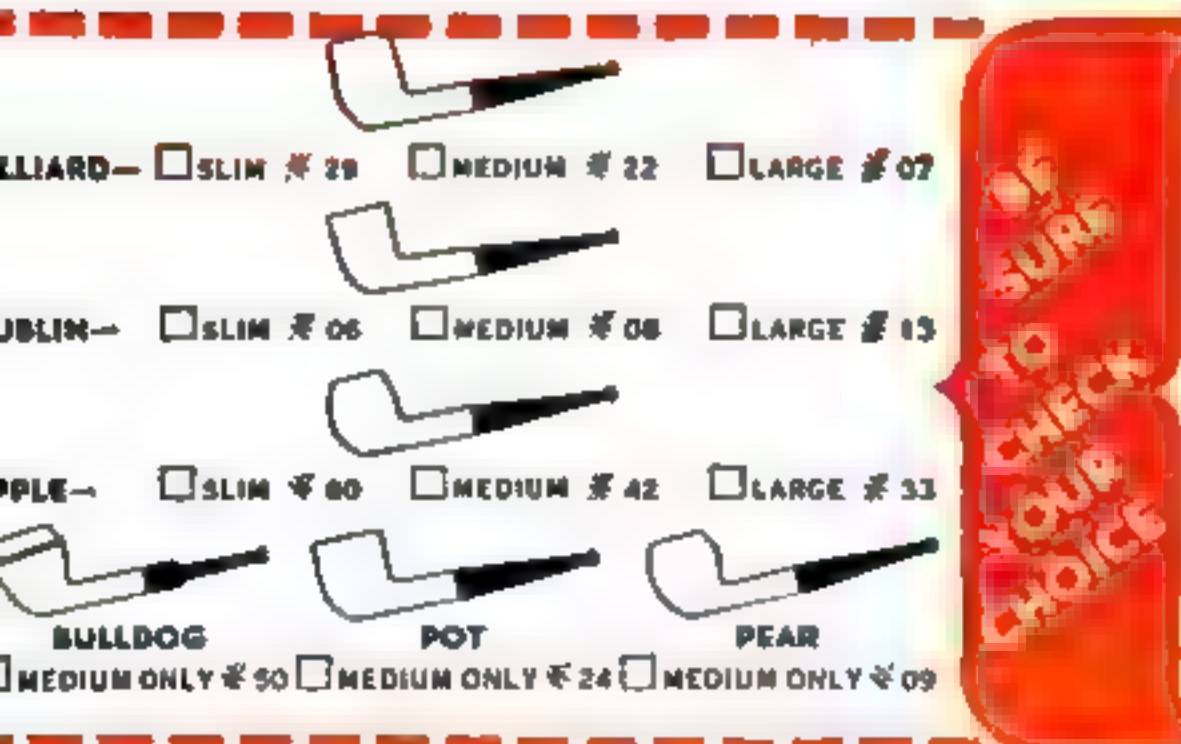
YOUR OWN PIPE, if in good condition, can be equipped with a "BRIAR HILL" STOKER—custom fitted by expert workmen. Just fill out coupon below and mail it to us with your pipe and **ONE DOLLAR**. (Wrap it well for mailing.) Your modernized pipe will be returned to you promptly, postpaid. (We do not change your stem or filter.)

If you prefer **A NEW PIPE**, send \$1.50 for the **BRIAR HILL "PIONEER"** a pipe of genuine imported briar, fitted with the BRIAR HILL STOKER, unexcelled in workmanship and smoking qualities regardless of price or name, whether domestic or foreign and *equipped to smoke either with or without a standard filter.*

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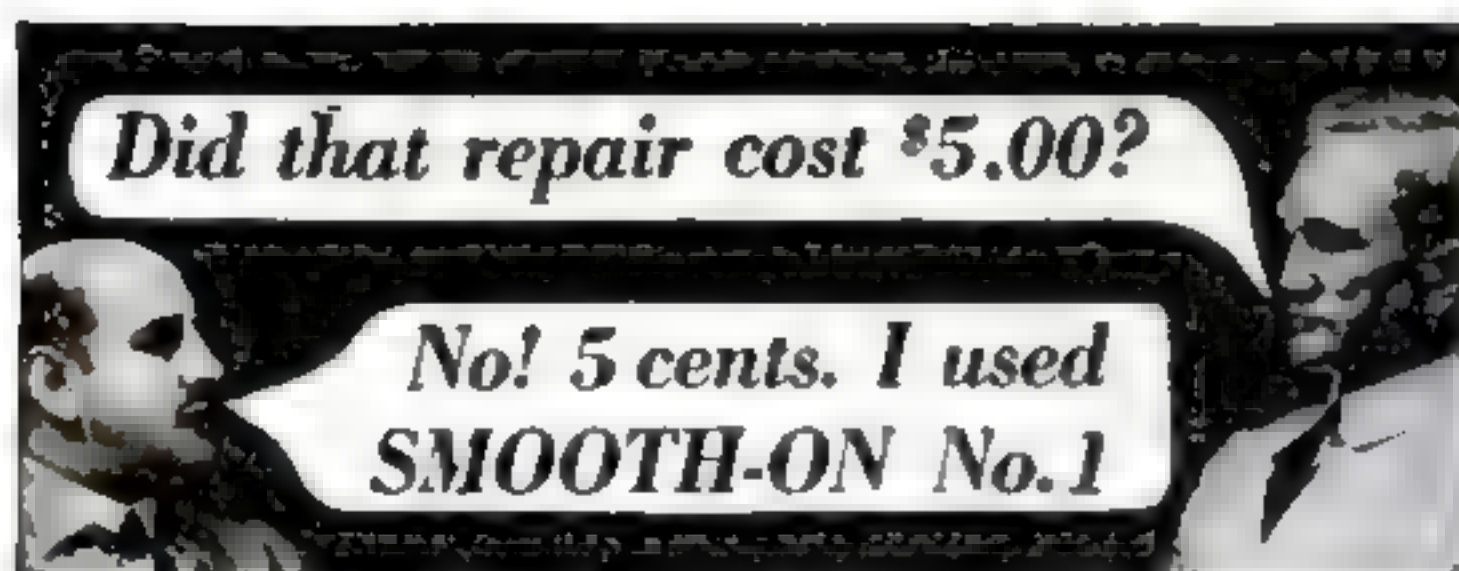
- ☐ I am enclosing \$1.00 and my favorite pipe. Please modernize it with a "BRIAR HILL" STOKER.
- ☐ I am enclosing \$1.50. Please send postpaid one BRIAR HILL "Pioneer" Model Stoker Pipe. Style and size marked at left. (Please mark first and second choice.)
- ☐ Please mail pipe literature showing shapes and models available.

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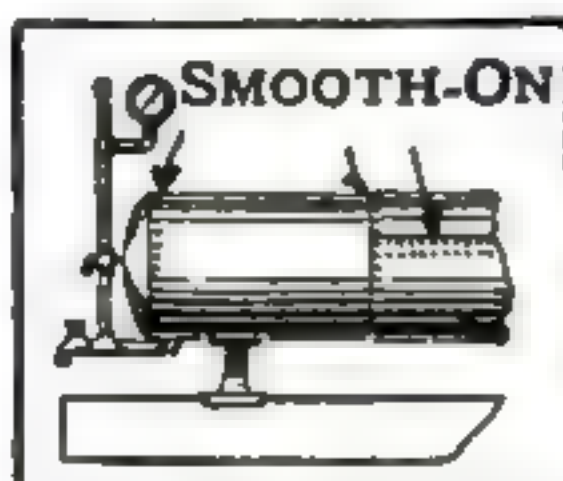
WATER, steam or gas may start to leak or screws, bolts and nuts may become woefully loose in any home at any time. Such nuisances cannot be avoided, but the trouble can be stopped in a hurry with Smooth-On No. 1, and at a cost seldom above a few cents.

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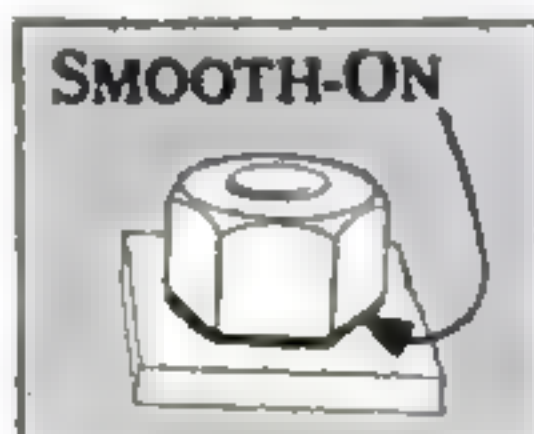
Get the Smooth-On habit and learn all the ways for using Smooth-On. You will then have a sense of security when called upon either to stop a leak or to get rid of many other common repair problems, and you will discover that jobs you once considered difficult are in reality very easy.

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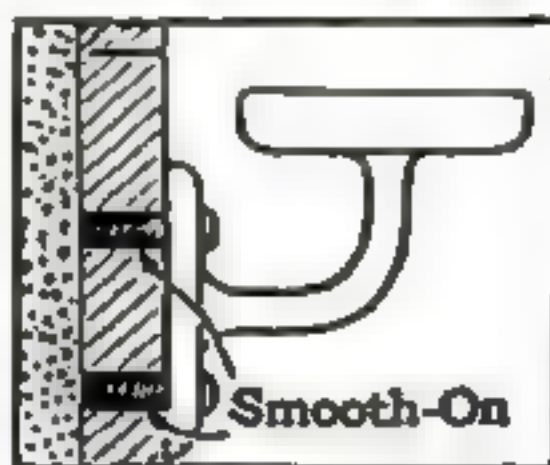
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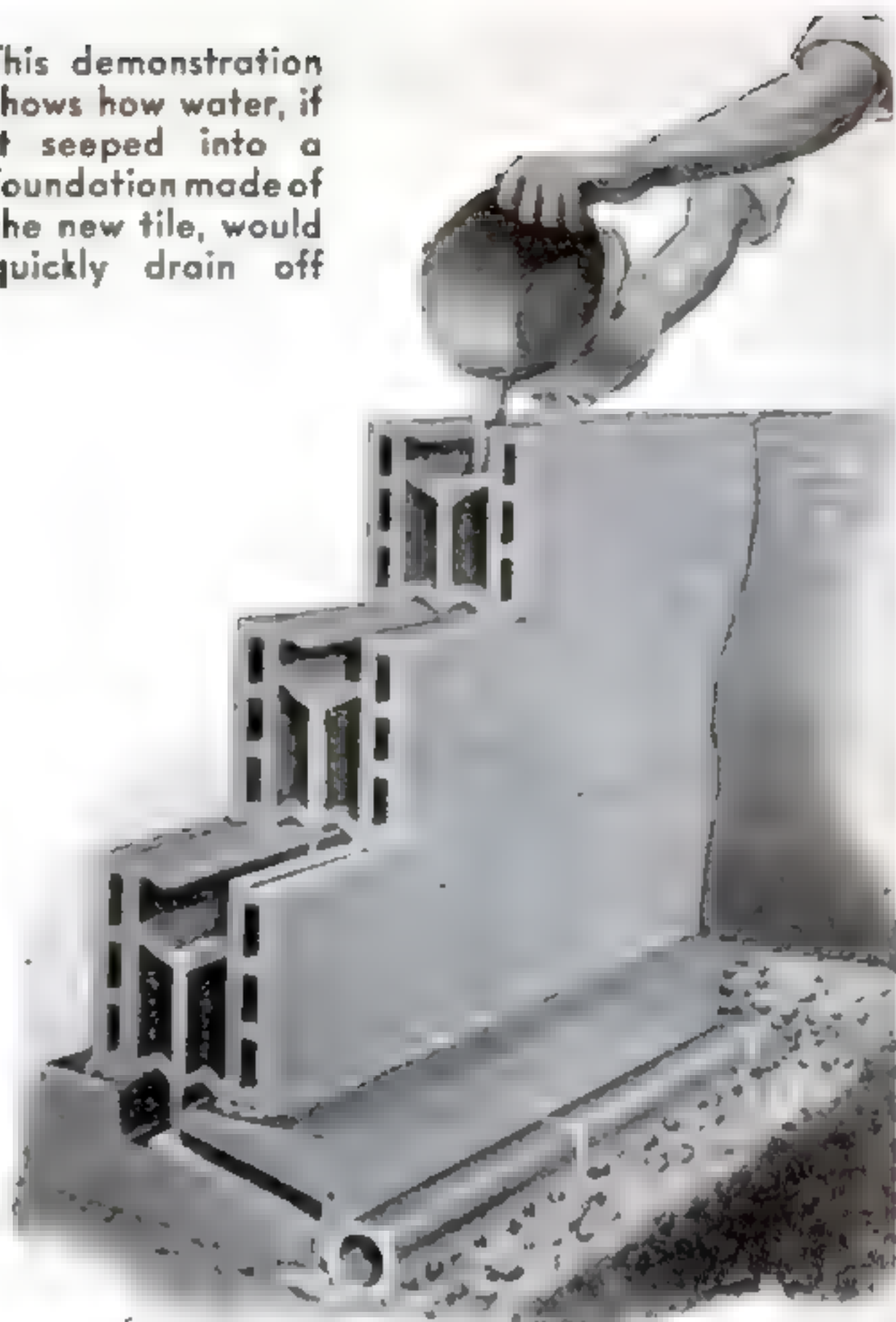
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This demonstration shows how water, if it seeped into a foundation made of the new tile, would quickly drain off

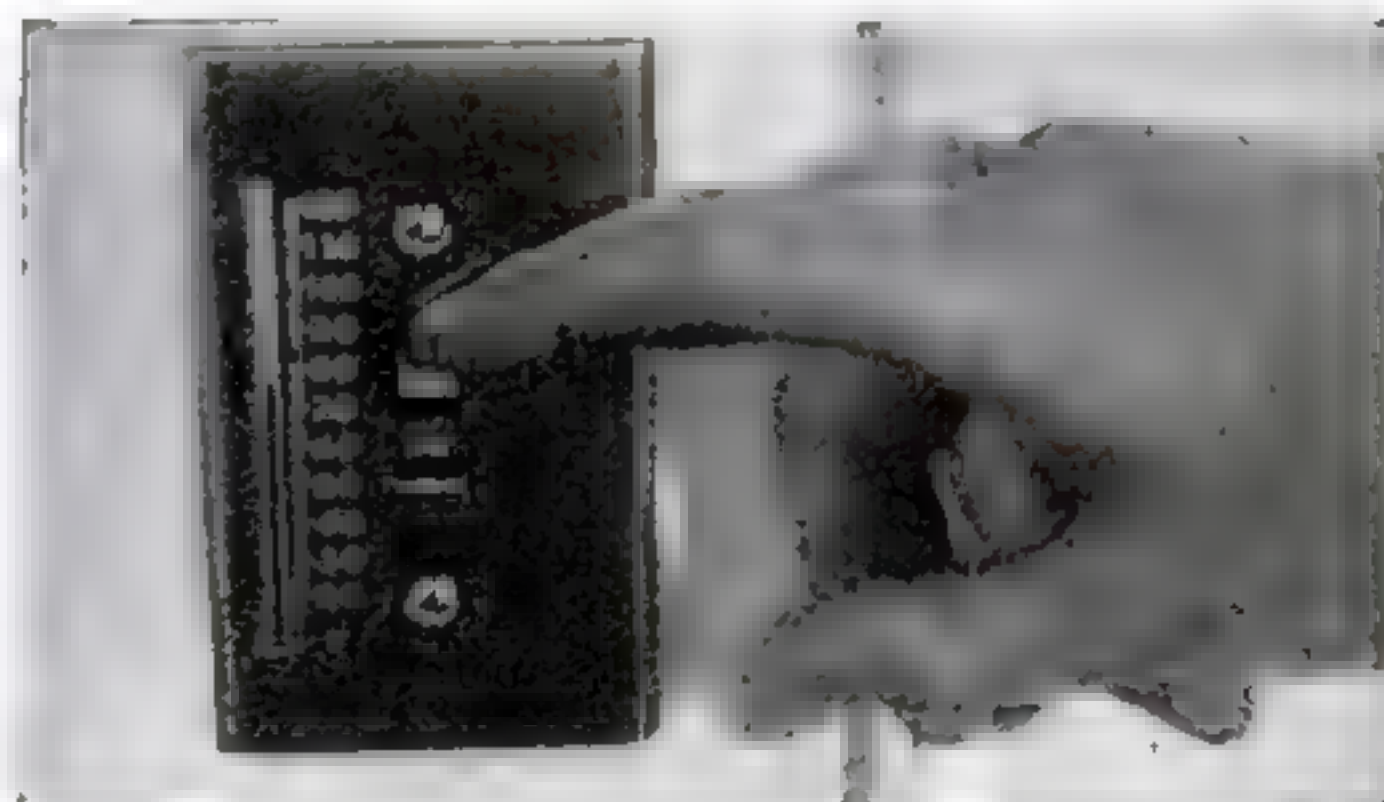


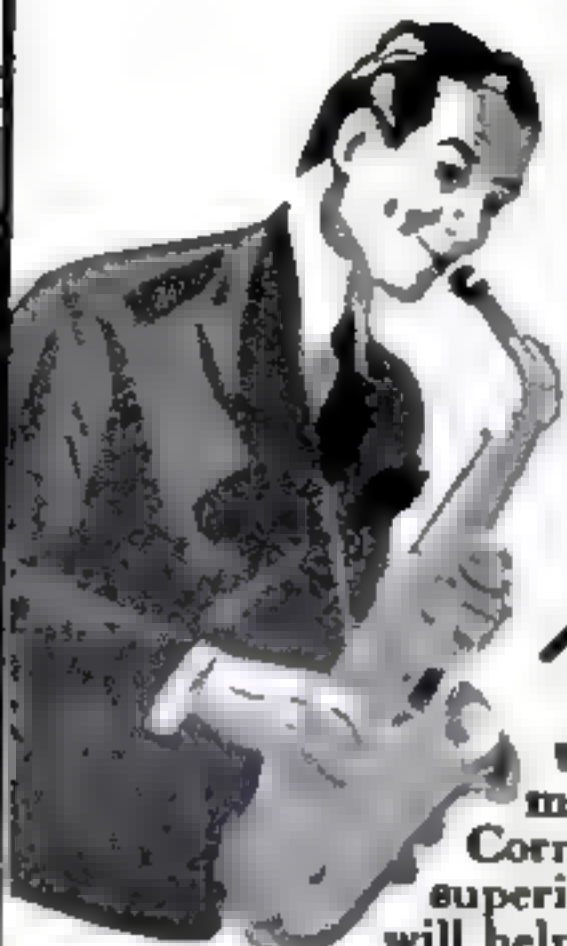
Drainage Gutter in Tile Keeps Basements Dry

DRY basements in homes are assured when foundation walls are constructed with new clay building tile having a built-in gutter that makes it self-draining. In the test shown above, which greatly exaggerates normal conditions, large quantities of water were poured into the upper rows of the tile. All the water rapidly flowed down the slanting gutter to the bottom of the foundation and passed off through the drain tile.

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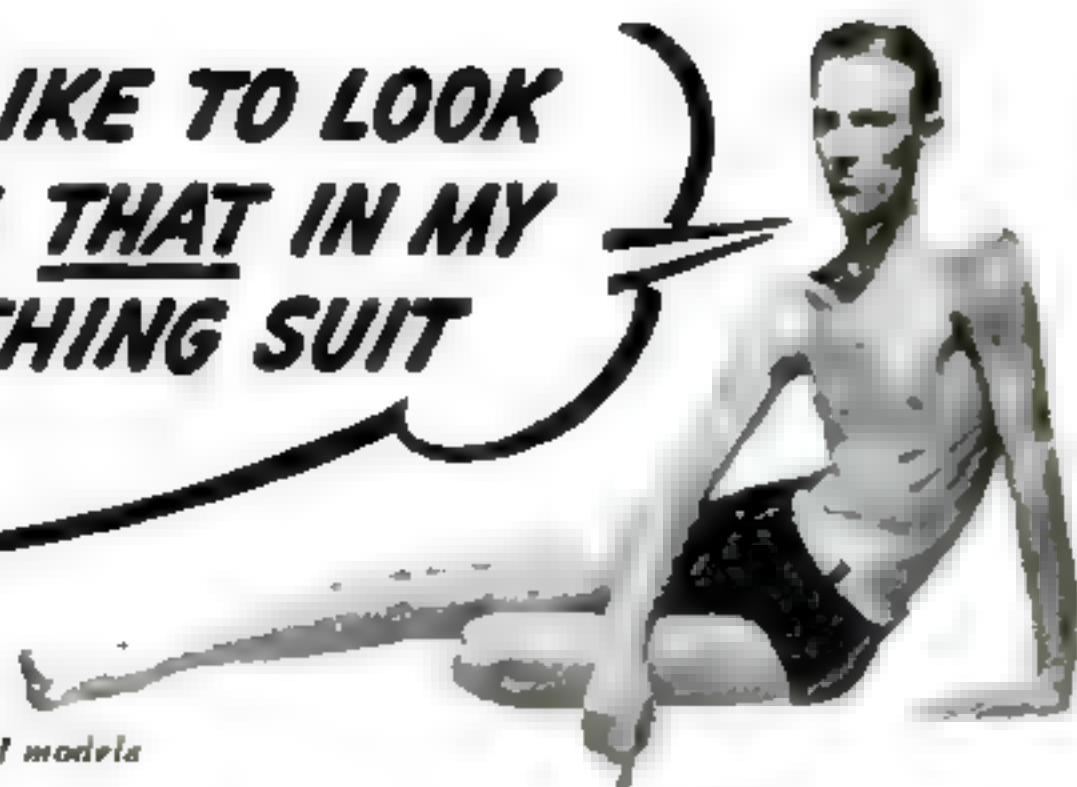
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New Clamp-on Bench Vise Holds Work at Any Angle

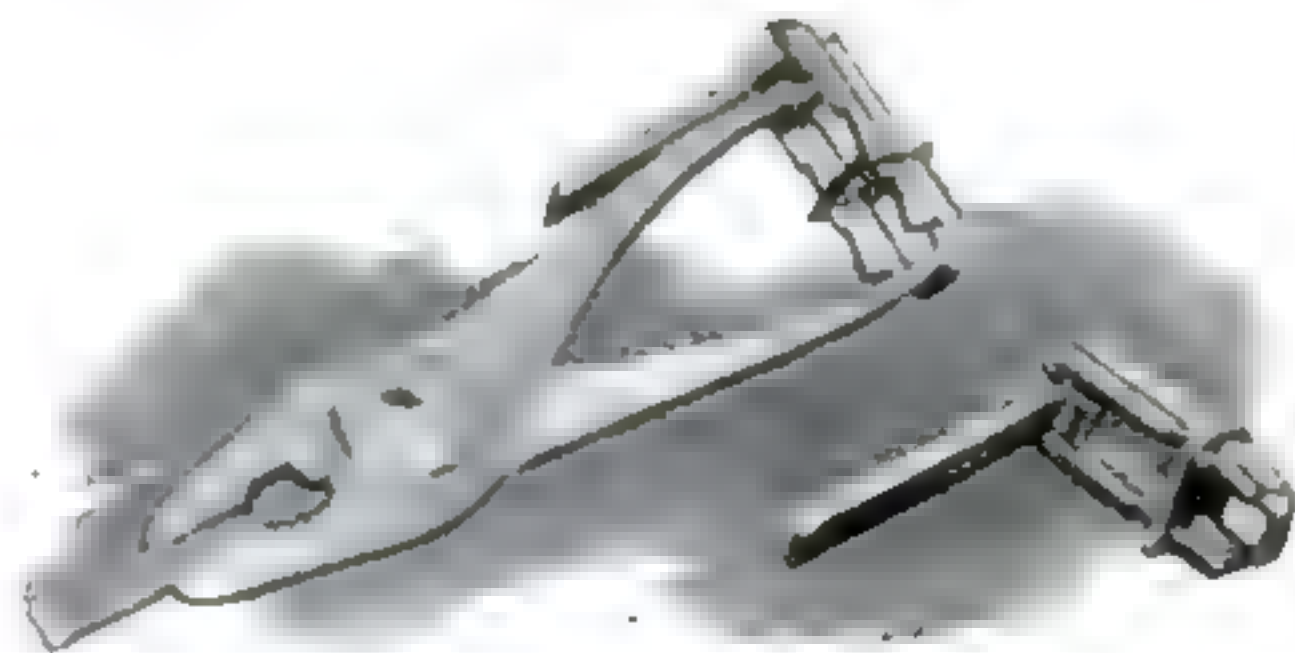
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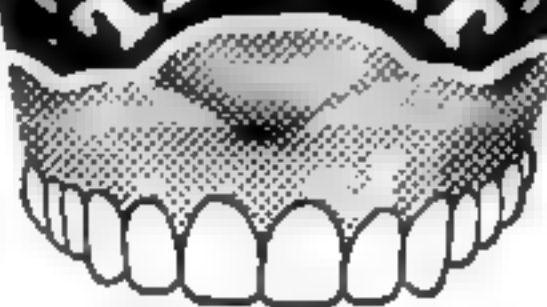
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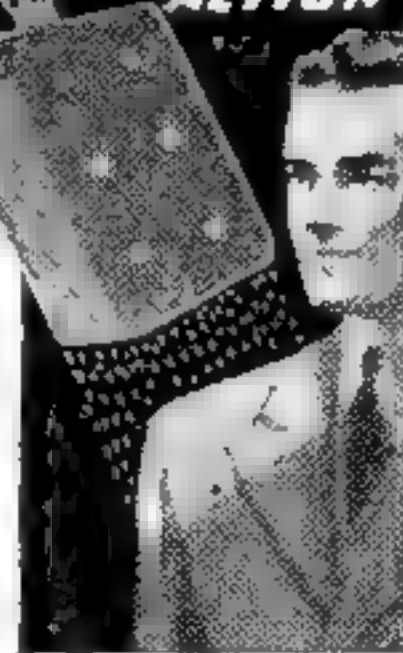
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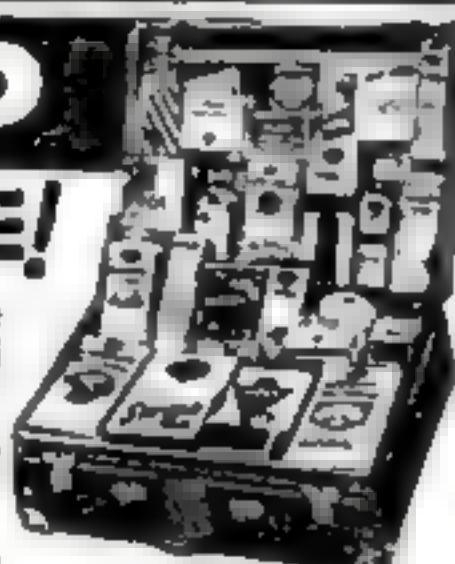
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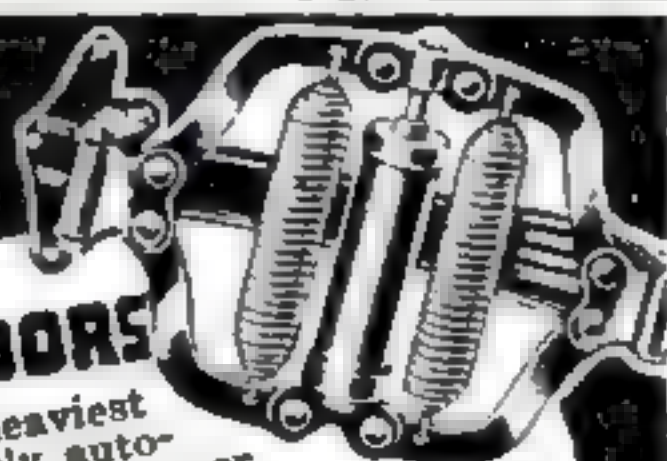
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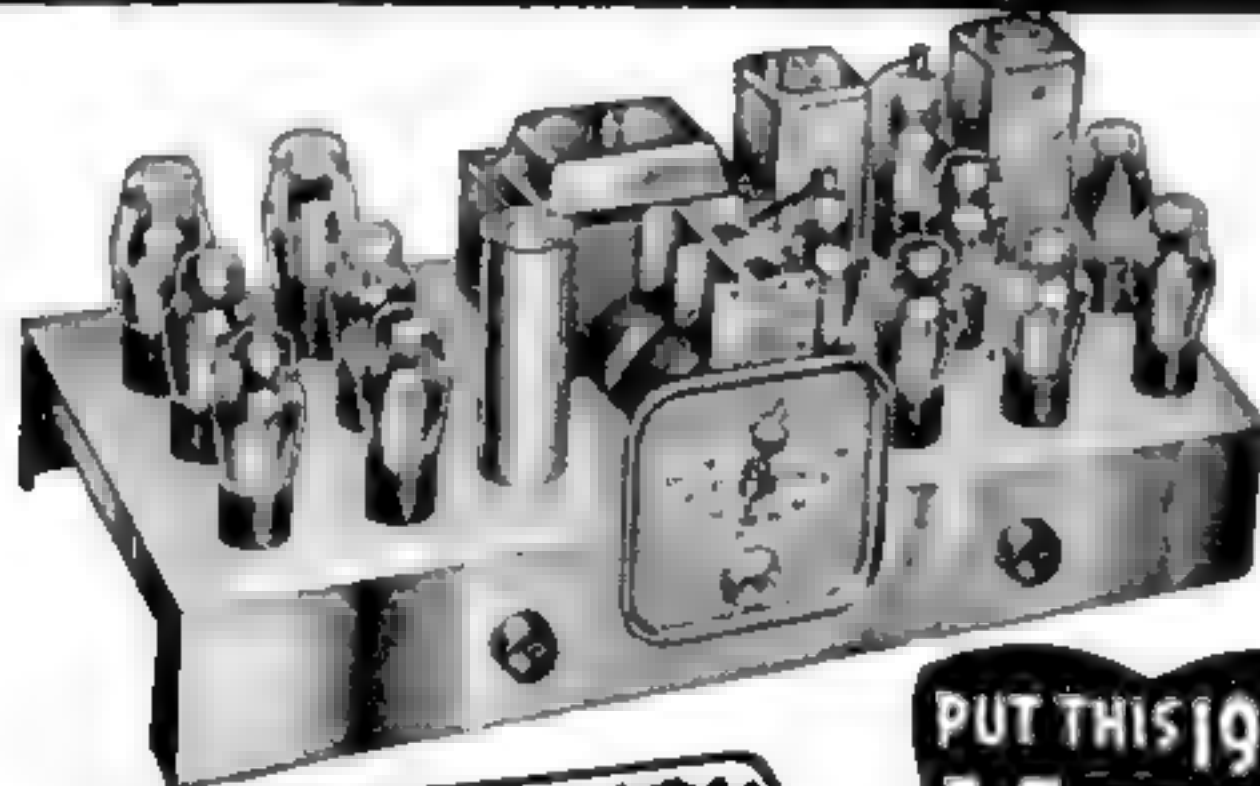
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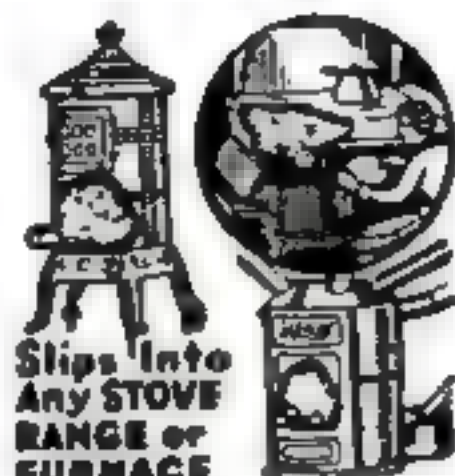
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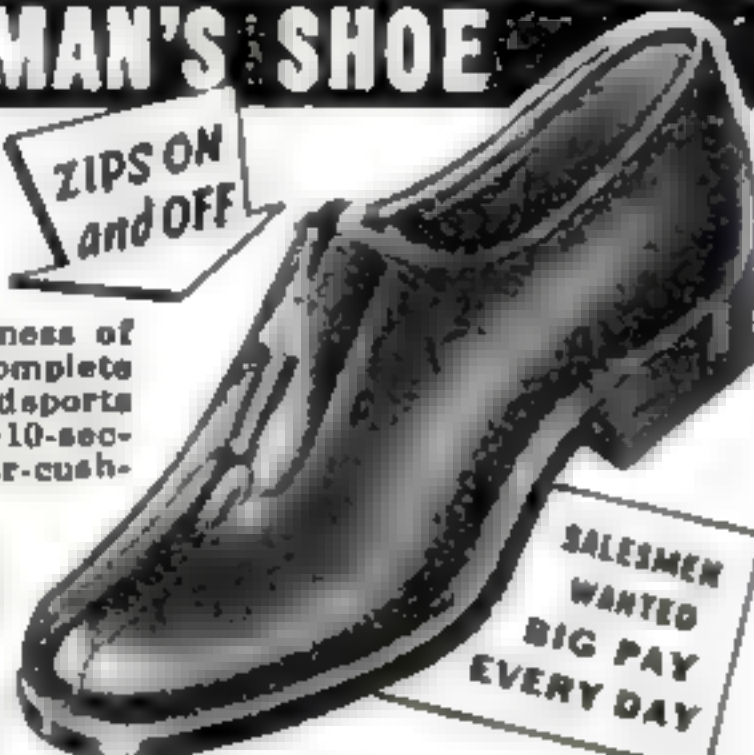
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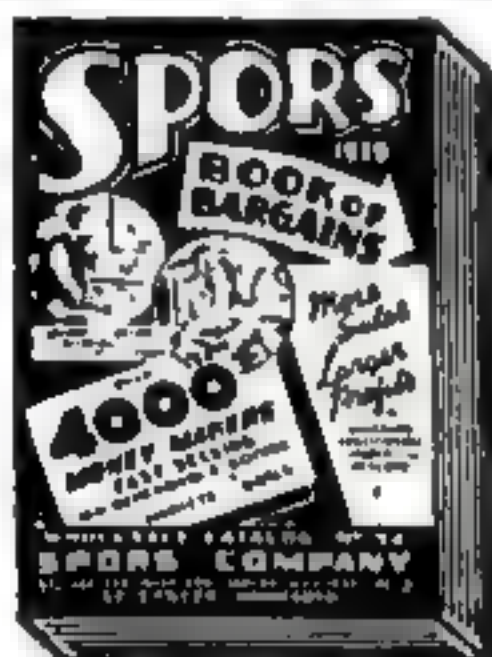


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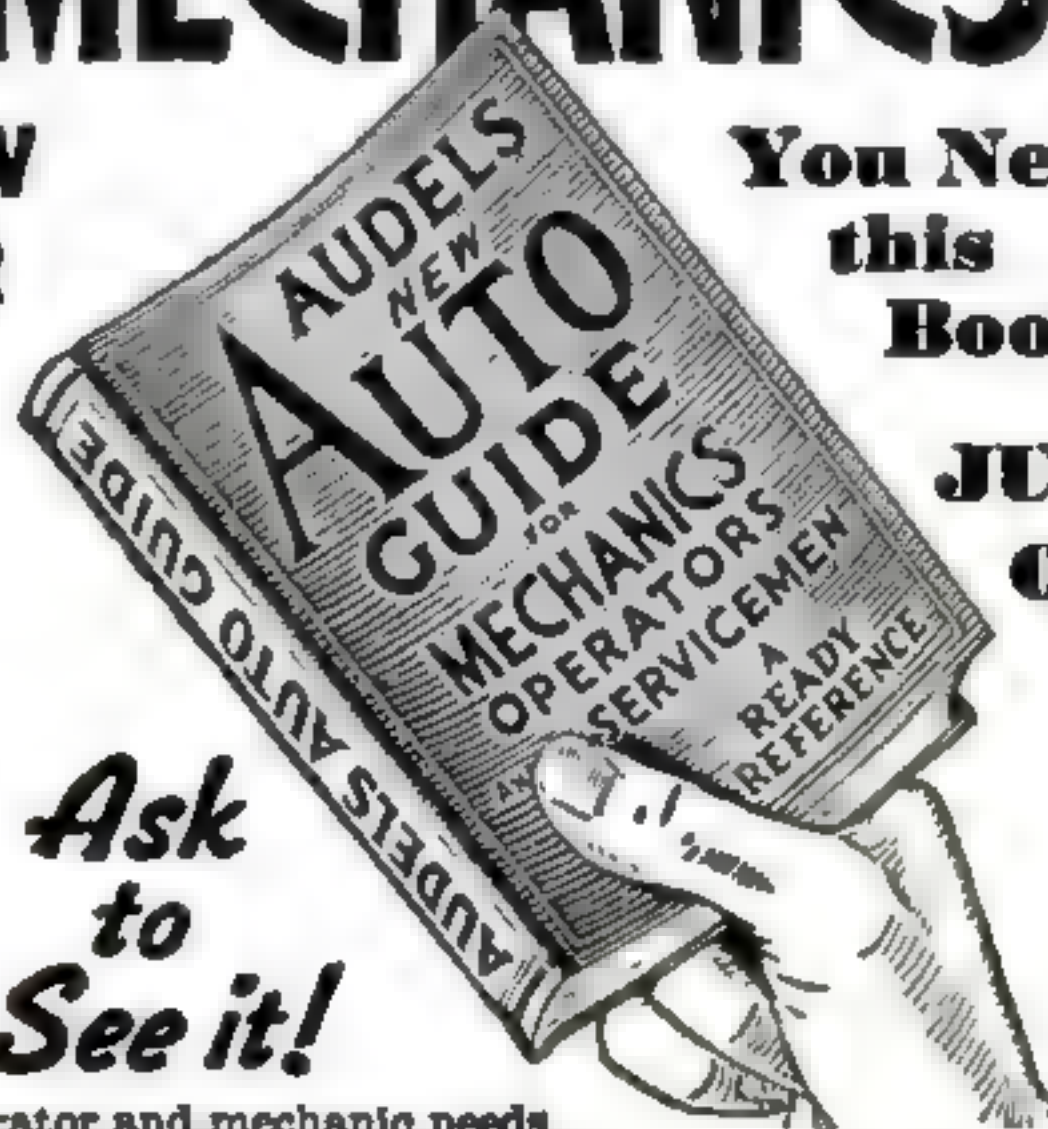
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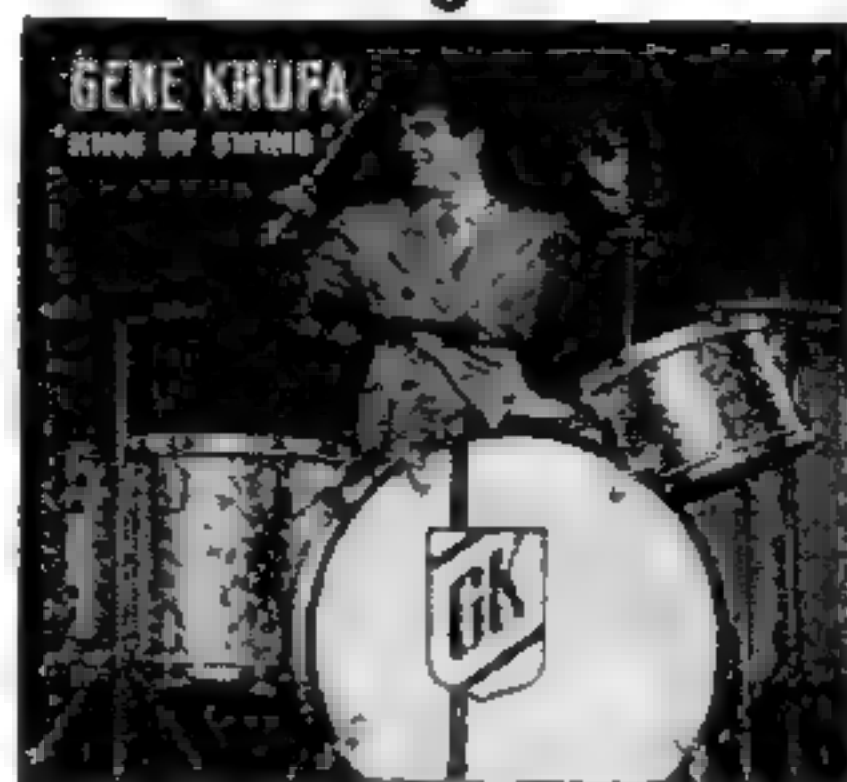
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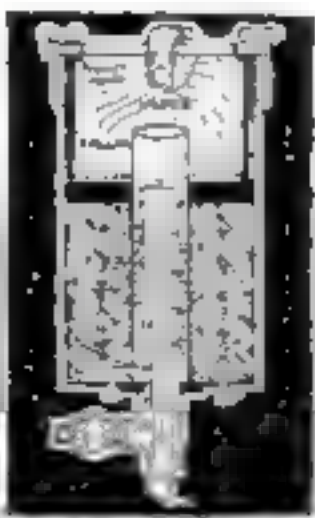
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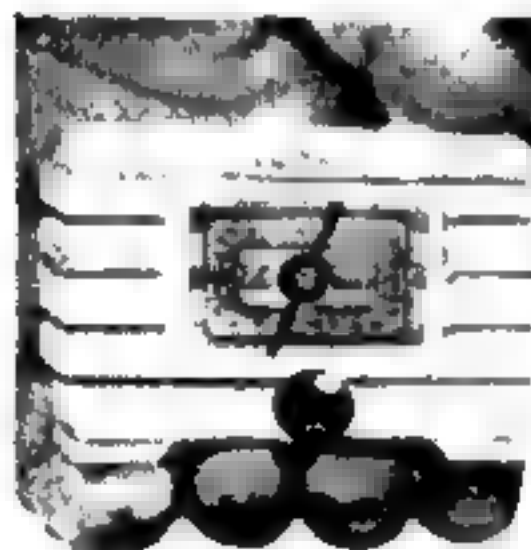
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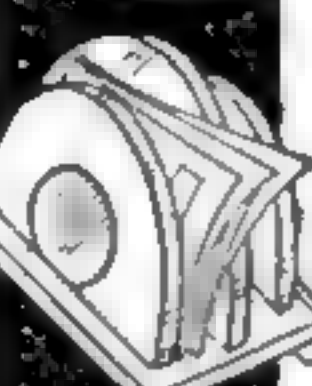
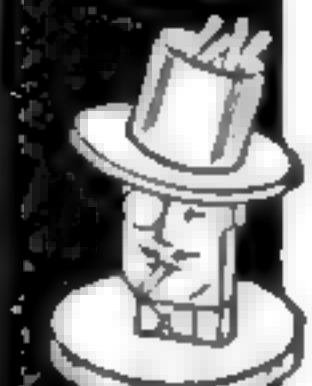
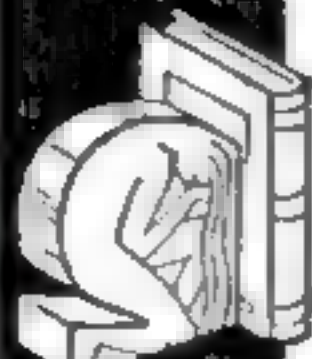
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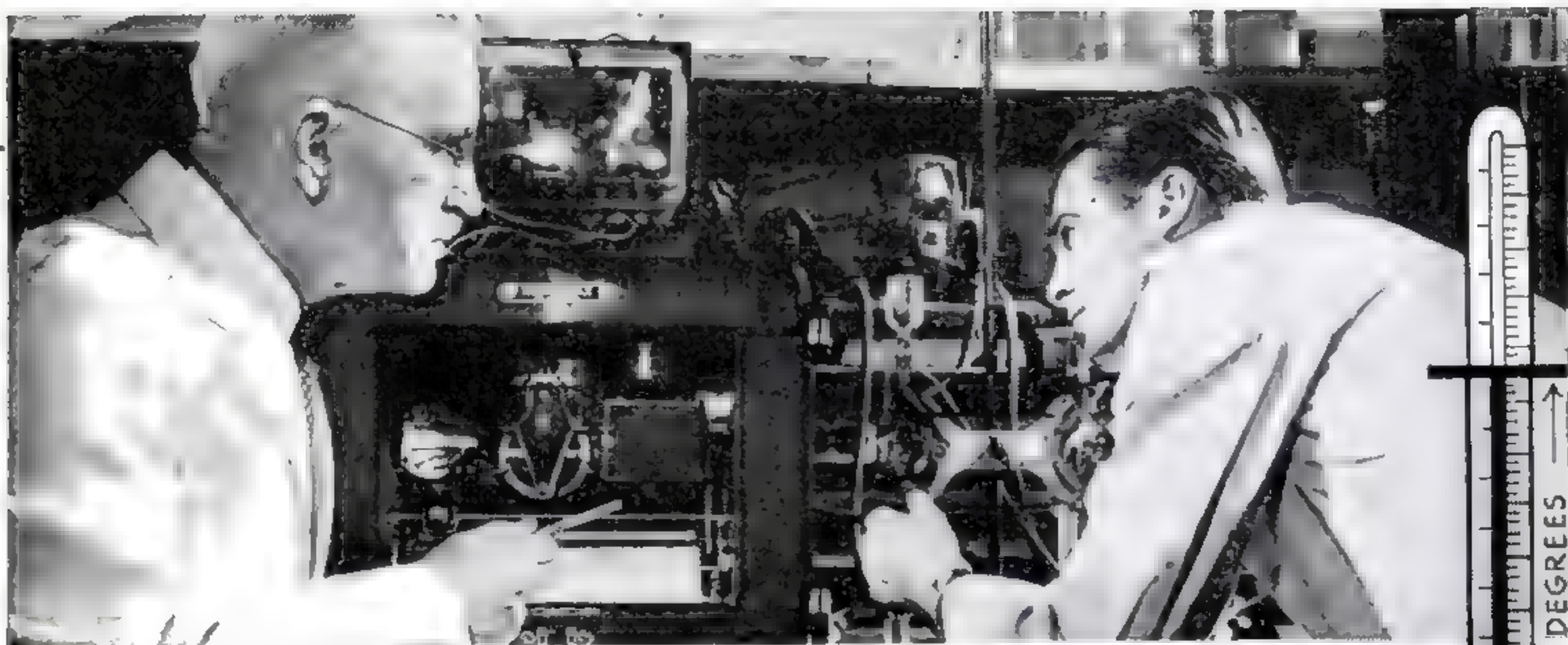
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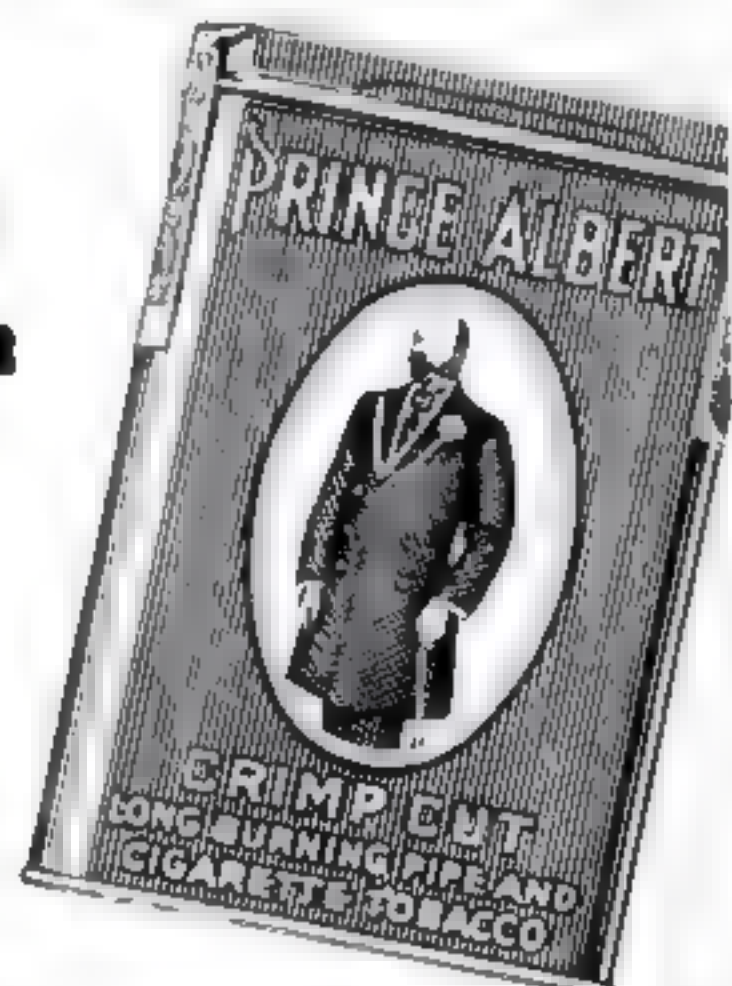
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CRIMP CUT. ENJOY
ALL THE PLEASURE
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50 pipefuls of
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Prince Albert

THE NATIONAL JOY SMOKE



Planting the Stars and Stripes in the Antarctic

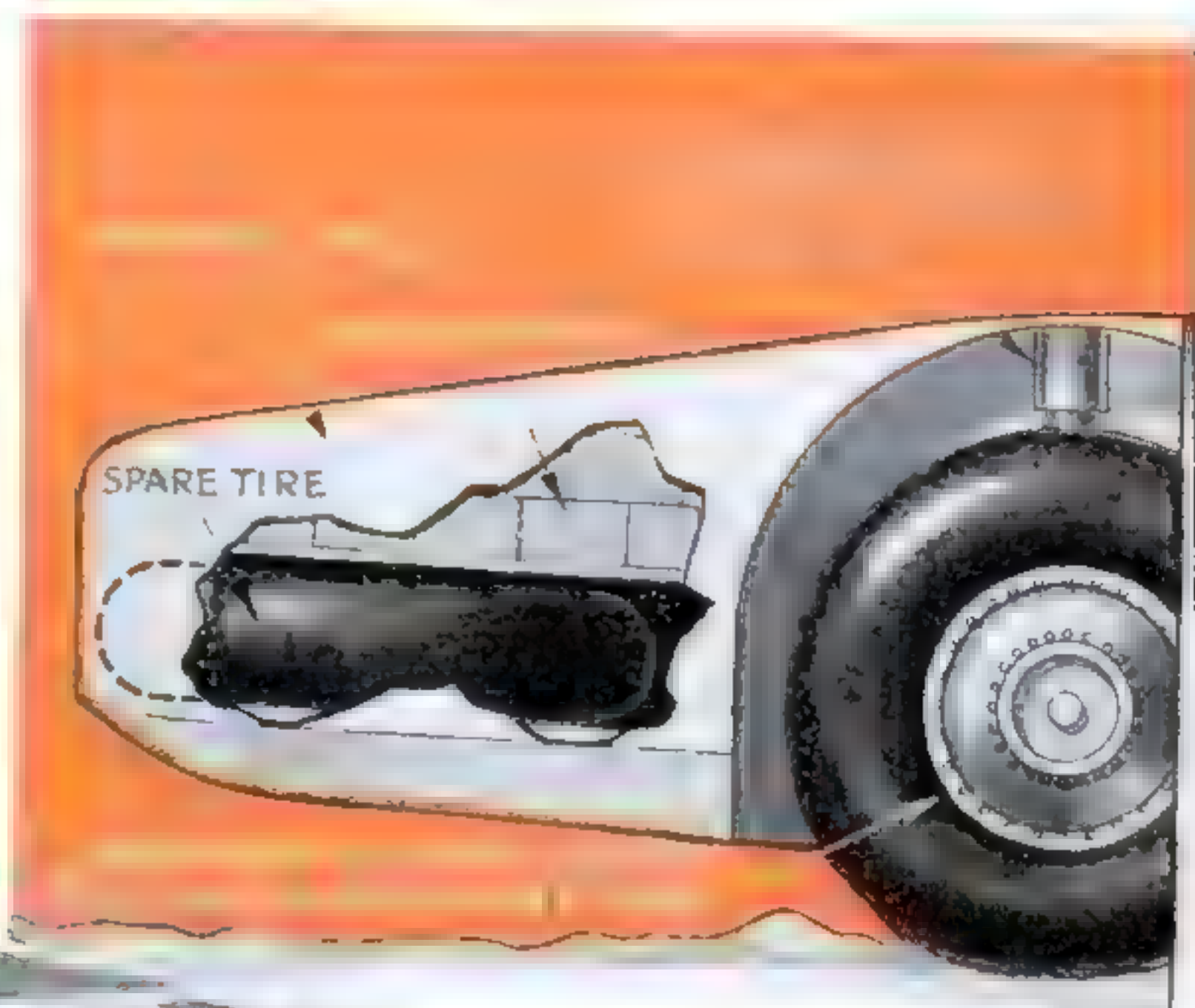
CRUNCHING snow and ice beneath ten-foot pneumatic tires, throbbing with the combined 400 horsepower of its mighty Diesel engines, a fifty-five-foot juggernaut with a swift airplane poised on its broad back soon will roll into polar lands of mystery. As fantastic a land craft as the strangest creations of fiction, this "snow cruiser" heads an array of scientific innovations that will serve the forthcoming U. S. Government expedition to Antarctica and the South Pole.

Scheduled to start early in October, the expedition marks the first official step to

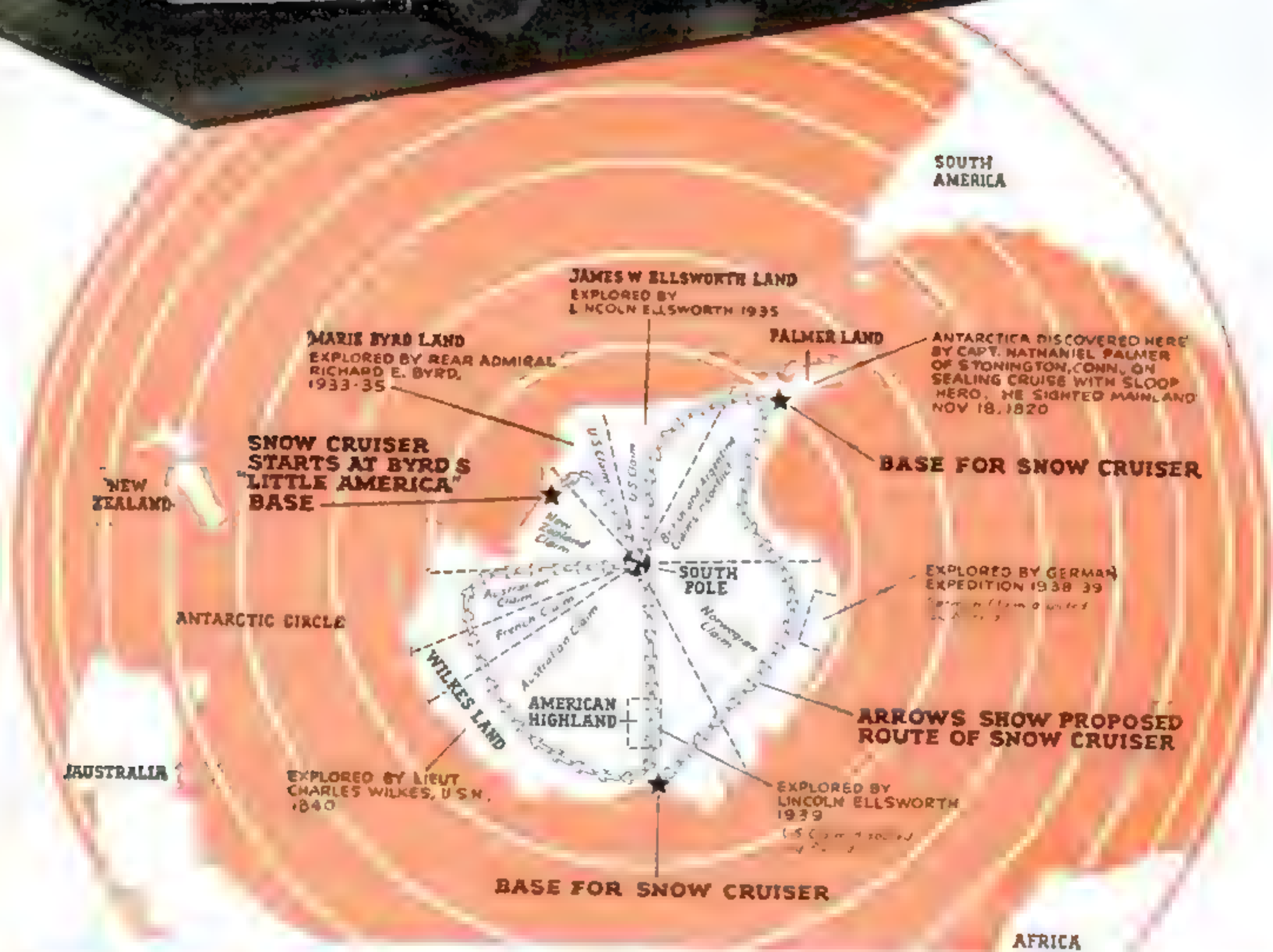
take possession, by actual occupation, of the vast sectors of the polar continent claimed for this country by Lincoln Ellsworth and Rear Admiral Richard E. Byrd. Its explorations may also strengthen long-pending U. S. claims to other areas first sighted by pioneer American explorers in the Antarctic.

Spurred by the increasing number of claimants to slices of the antarctic "pie," which now include Argentina, France, Germany, Great Britain, and Norway, Congress voted initial funds of \$340,000 for the project last June. The result is a newly created

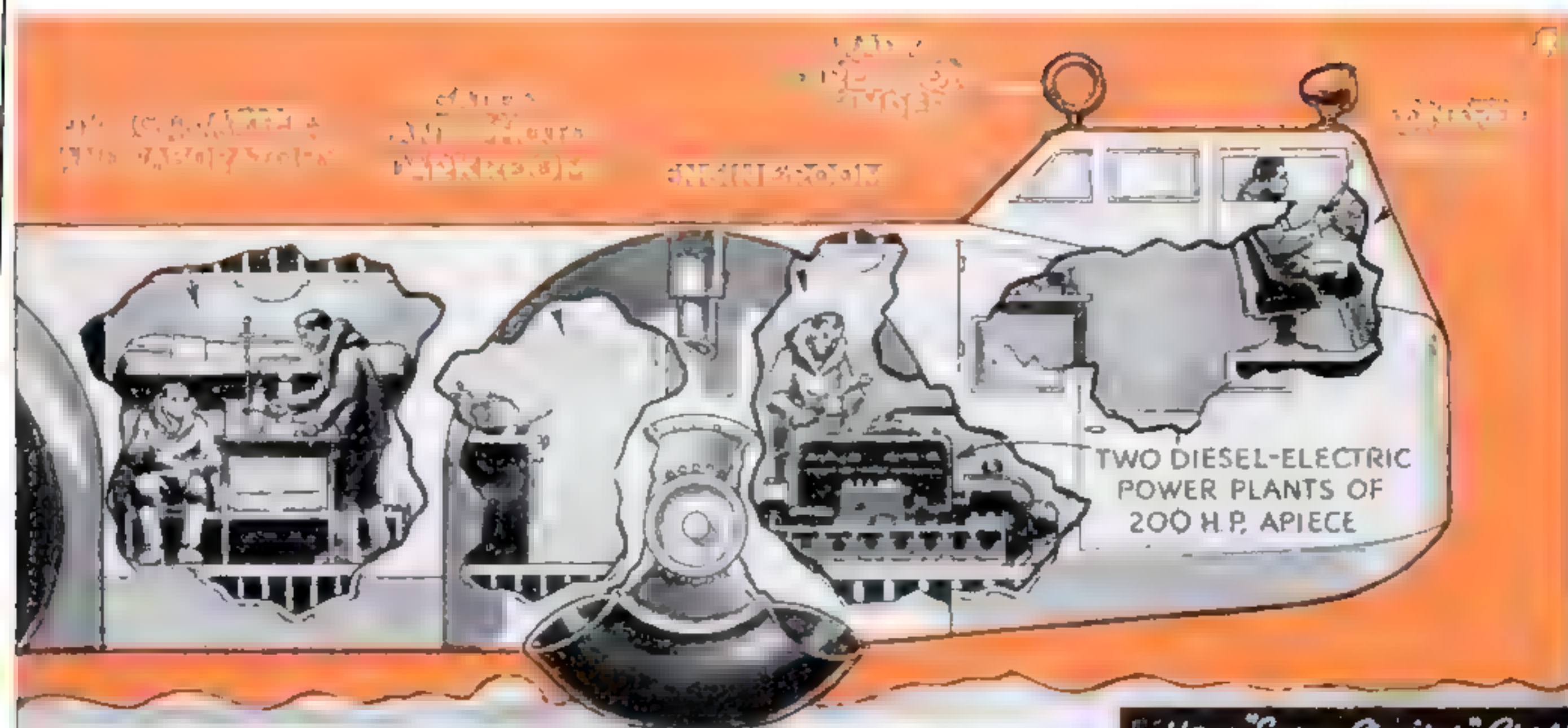
This is a model of the huge "snow cruiser" in which a party of American explorers plans to cross the South Pole



Details of the queer land craft. Its proposed route is shown by arrows on the map



AMAZING "SNOW CRUISER" TO CARRY POLAR PIONEERS TO STAKE OUR CLAIMS AT THE BOTTOM OF THE WORLD

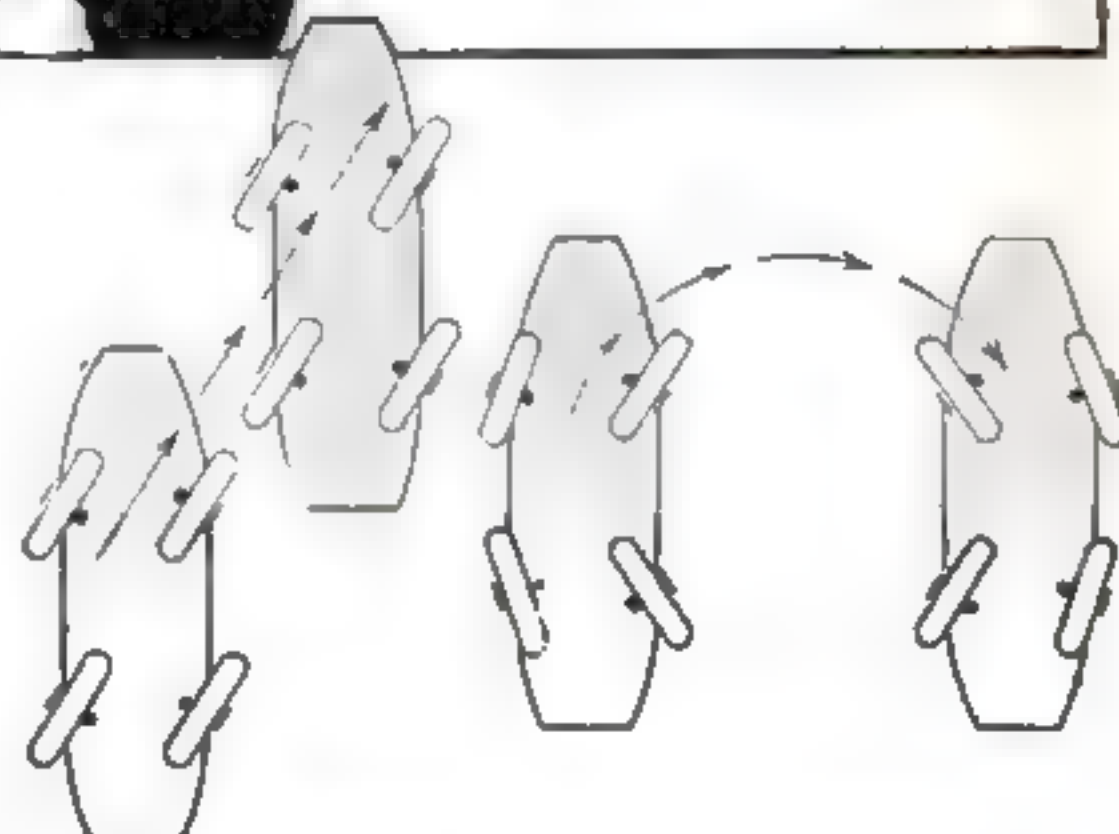
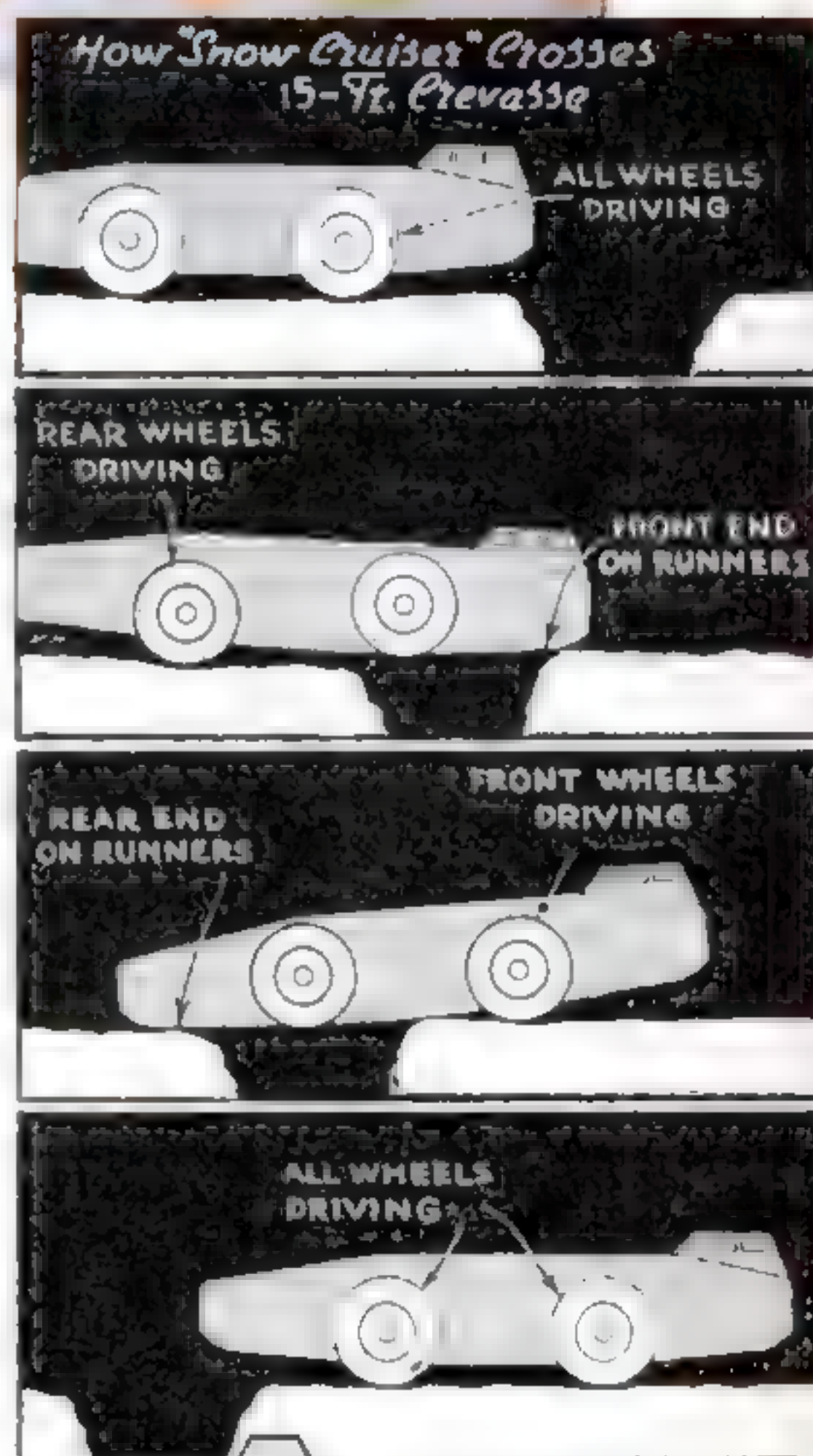


Government bureau, the U. S. Antarctic Service, with Admiral Byrd as its head. Leading a party of 160 men, he will establish three semipermanent bases in antarctic wastes now inhabited only by penguins and seals. Each year new "colonists" will be sent to relieve their predecessors, on the principle that continued occupancy affords the best claim to new land. Formal annexation of American zones in Antarctica may come at a later date—perhaps after an international commission has settled conflicting claims, and fixed boundary lines, by joint agreement or arbitration. The territory to which our claims are undisputed, alone, would add an area vaster than Alaska to U. S. domains.

Why do we want this frigid land? Not only to protect our whaling interests, and to establish weather observatories that would prove an invaluable aid to long-range forecasting. Coal resources second only to those of the United States, together with oil, copper, nickel, and tin, await those who develop Antarctica. Air bases, both commercial and naval, may be established one of these days on the polar continent. Only about 575 nautical miles, a few hours' flight for either a clipper plane or a bomber, separate the tip of South America from Palmer Land in the Antarctic. That lends point to our objective of extending the Monroe Doctrine, and forestalling the encroachment of foreign powers in the Western Hemisphere, clear to the pole.

Lessons learned by past expeditions will aid the present one. One hazard formerly faced by polar pilots, returning to their bases, was sudden snow or fog that cut visibility almost to zero. This time they will follow the beam of a miniature radio transmitter back to the base camp, like a commercial airliner making port.

Sledge dogs drugged with opiates, each in its aluminum crate, will be flown to points far inland. Noise and strangeness of airplane flight drove the high-strung animals insane with fear, when a previous expedition tried transporting them by air. Humane use of "knock-out drops" will now permit



AS FANTASTIC AS A PRODUCT OF JULES VERNE'S BRAIN

As illustrated above, wide crevasses in the ice will hold no terrors for this polar juggernaut. Special steering arrangements make many maneuvers possible



Rear Admiral Richard E. Byrd, who was appointed to head the newly created U.S. Antarctic Service

the time-saving transportation expedient.

Six Army tanks—without guns—will accompany the new expedition. Tractors for hauling sledge loads of food and supplies were introduced in the Antarctic by the Byrd expedition of 1933-35. Tanks, with their longer and wider treads, are expected to prove better yet.

But, the giant 45,000-pound, \$150,000 "snow cruiser" will be something absolutely unprecedented in polar exploration. As described by the modern Jules Verne who designed it—Dr. Thomas C. Poulter, senior scientist and second in command of Byrd's last expedition—it will carry four men, a year's supply of food, and fuel for 5,000 miles. The property of the Research Foundation of Armour Institute of Technology, who lent it to the Government, it carries an airplane and can penetrate within easy flying distance of any point on the Antarctic Continent. At each trip, its plane will cut a swath 500 or 600 miles wide through unexplored regions.

As tentatively planned, the route of the snow cruiser will take it at least twice to the South Pole, during a crisscross tour of Antarctica. On level stretches it will "cruise" at ten or twelve miles an hour, keeping one of its two Diesels in reserve. It will

have a top speed of twenty-five miles an hour. Capable of climbing a thirty-five-percent grade, it will have no trouble traveling to the great central plateau of Antarctica, 11,000 feet above the sea.

A single pilot drives the snow cruiser. From his control room he can apply Diesel-electric power, through individual electric motors, to any combination of one to four wheels. Hydraulic steering controls will turn front and rear wheels in opposite directions, giving a turning radius of only thirty feet. To sidestep an obstacle, front and rear wheels may also be turned the same way.

One of the greatest problems of antarctic explorers—gaping crevasses in the snow and ice, which have held up parties for days while they sought a safe passage—is solved by the snow cruiser. Through another ingenious adjustment of its wheels, it may be driven straight over fissures as wide as fifteen feet. On reaching such a gap, the cruiser stops and retracts its front wheels, lowering its forward end upon sledlike runners. The back wheels then propel the cruiser halfway across the gap. Here the process is reversed, the front wheels being lowered and the rear ones retracted. Finally the rear wheels are lowered and the cruiser proceeds.

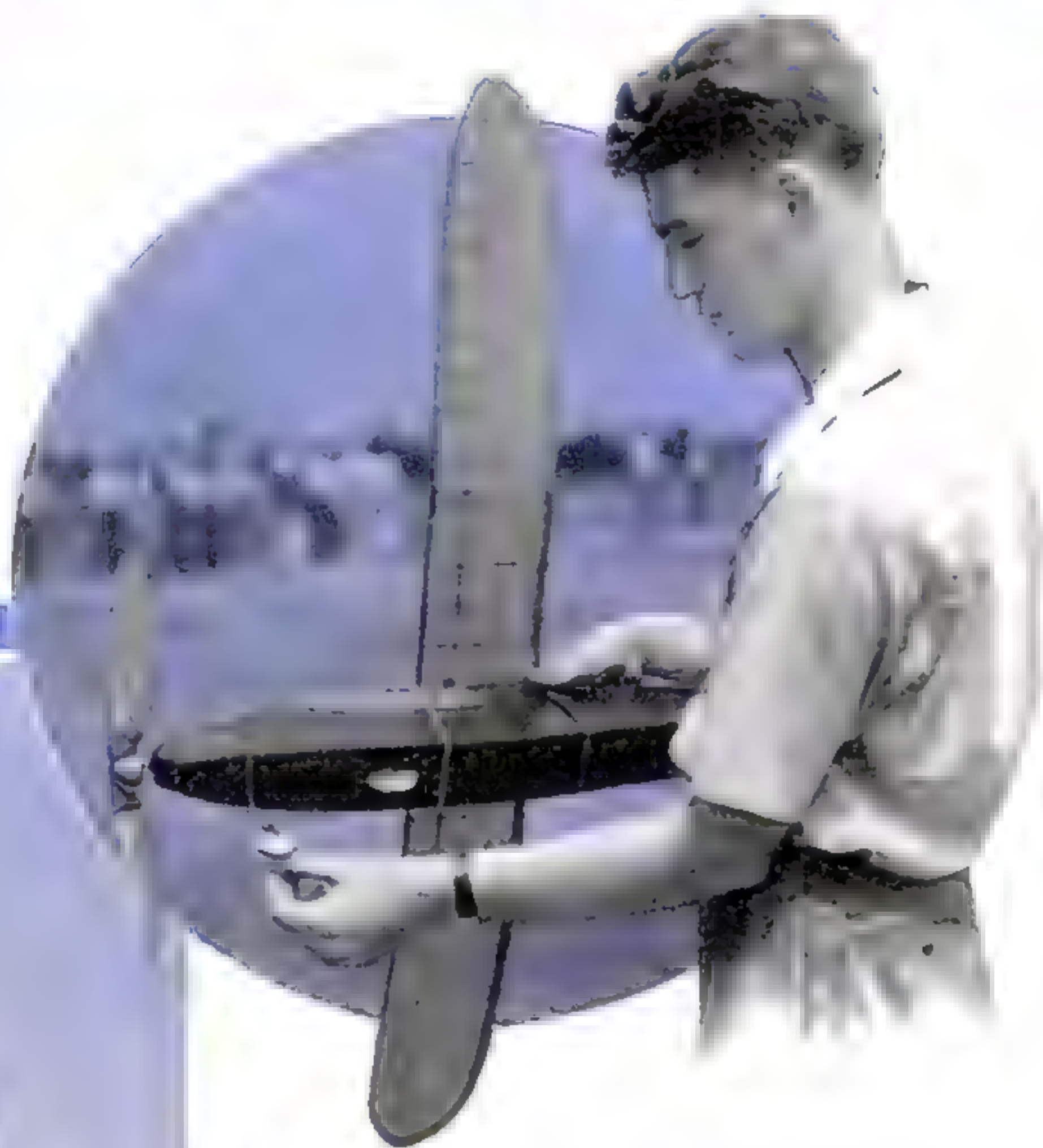


One of the four ten-foot, 700-pound tires made for the "snow cruiser." Its special rubber will stay pliable in extreme cold

NOVEL INVENTIONS AID Model-Plane Champions

THIS PLANE RETRACTS ITS LANDING GEAR

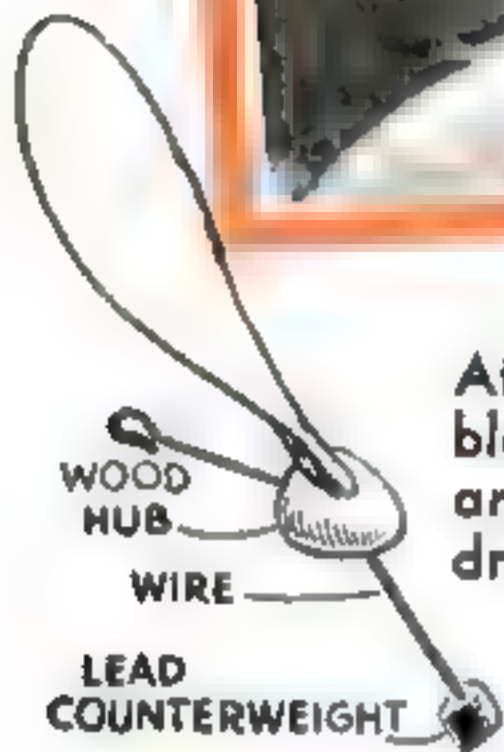
The single wheel on the model at the right springs back into the fuselage as soon as the midget plane clears the ground. Below, the tiny craft is seen starting its duration run at the Wakefield Trophy Meet in New Jersey



Builders of Midget Craft Try Out Ingenious Ideas in a Miniature Air Meet

PROGRESS in miniature-airplane design was dramatized a few weeks ago when contestants representing seven countries, England, France, Belgium, Canada, South Africa, the United States, and New Zealand, battled for the coveted Wakefield Trophy at Bendix Airport in New Jersey. Won by Richard Korda, of Cleveland, Ohio, the international classic brought out a host of ingenious innovations.

Korda's featherweight monoplane, for example, was pulled through the air by a novel single-bladed, counterbalanced propeller which folded back to decrease resistance when the rubber-band motor was completely unwound. This feature lengthened the glide at the end of the flight, piling up precious seconds in the race for



At left is the single-bladed, counterbalanced propeller that dragged the winner to victory. Prop at right folds back when motor quits



maximum duration. Powered only by rubber bands, Korda's little ship soared above the field for forty-three minutes and eleven seconds, setting a new world's mark for duration.

Another American entry carried an automatic retractable landing gear. As soon as this streamline racer lifted from the runway, its single-wheel landing gear snapped back into a compartment in the lower side of the fuselage.

Other novel methods were used to solve the problem of

A British contestant has his entry "on ice" until the start of the trials, to get more power from the rubber-band motor



"Free-wheeling" on a French entry. When tension lessens in the rubber bands, a hub pin frees the prop from the motor

Model pilots judge the direction of the wind by tossing a handful of dry grass into the air. Models take off into wind, just like big planes



cutting down air resistance, especially on the terminal glide. One two-bladed propeller "broke in two," the blades folding back along the nose of the fuselage, as soon as the power gave out. A French monoplane had a "free-wheeling" mechanism on its propeller.

Knowing that rubber relaxes when cool and contracts when warm, one English competitor kept his entry in ice bags until the last minute. As the rubber motor warmed during the flight, it contracted, thus giving added power to the plane.



All the way from South Africa came this trim little racer. Entries also came from France, England, Belgium, New Zealand, and Canada, as well as the U.S.



The Canadian model at the left is remarkable in that its wing is set above the fuselage. Builders are always trying out new ideas

AN AIR MEET IN MINIATURE

"Flyers" preparing the tiny ships for the contest. Except England and Canada, foreign countries were represented by American "proxies," who flew the planes shipped from abroad

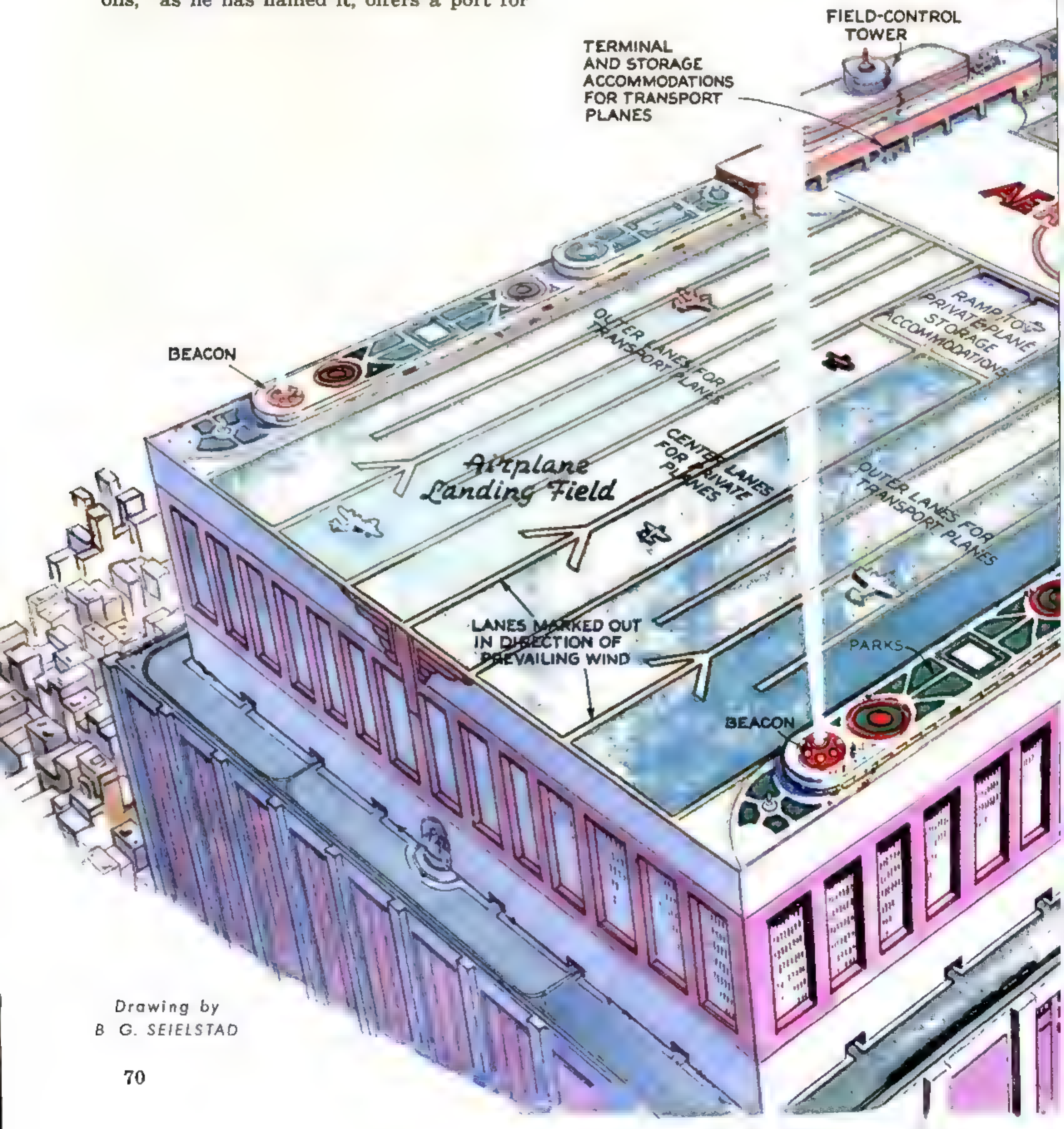


Skyscraper Airport

WHAT the metropolitan skyport of tomorrow may look like, as conceived by Nicholas DeSantis, New York commercial artist, is shown in the illustration below. His remarkable proposal, embodied in a model that he has completed after five years' study of the project, calls for a 200-story building capped by an airplane field eight city blocks long and three blocks wide. A lower level of his "aerotropolis," as he has named it, offers a port for

lighter-than-air craft. Hangars for planes and airships occupy the top fifty floors.

Commuters living 100 miles or more from the city would fly to work in their private planes. Landing on the roof, they would descend by elevators and moving platforms to an indoor parking space for 250,000 pri-



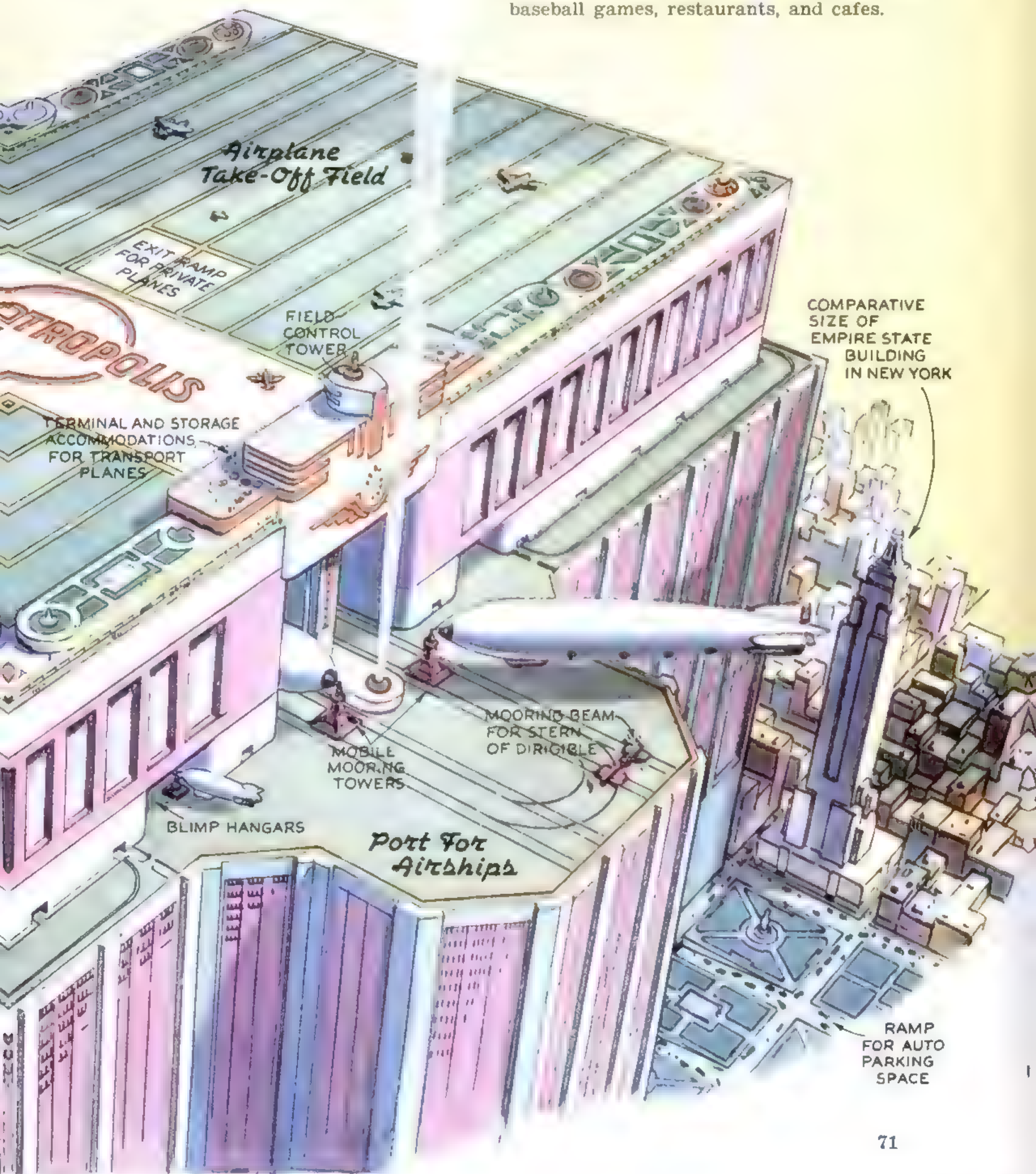
Drawing by
B. G. SEIELSTAD

for City of Tomorrow

vate cars and taxis, whence they would be whisked without delay to their destination. Similar facilities would serve passengers arriving by transport planes and airship lines. By centralizing air and land terminals

in one building, the "aerotropolis" would save time now lost in journeying to and from airports far from the heart of a city.

Other parts of the building provide space for offices and light industrial plants, theaters, two enormous arenas for football and baseball games, restaurants, and cafes.



World's Champion

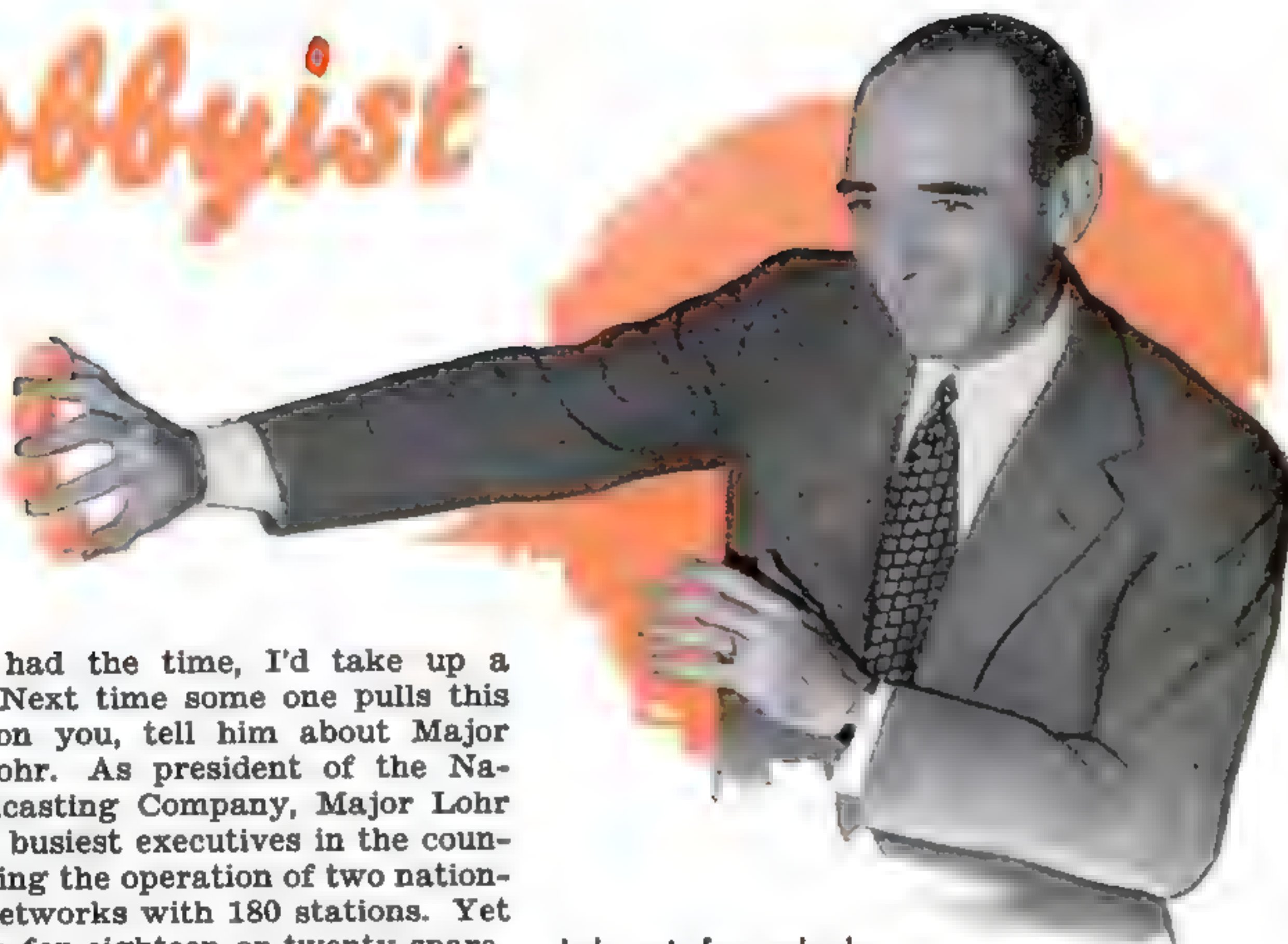
At the left, Major Lenox R. Lohr is demonstrating his trick crystal ball. It glows with weird colors under "psychic" influence. Below are two model boats he built. The larger craft is powered by a two-cylinder engine supplied with superheated steam by a boiler heated by a blowtorch



Here the president of the National Broadcasting Company is at work in one of his elaborate basement workshops. At the right is a part of his gun collection, an outgrowth of a boyhood interest in firearms



Hobbyist



"If I only had the time, I'd take up a hobby!" Next time some one pulls this old line on you, tell him about Major Lenox R. Lohr. As president of the National Broadcasting Company, Major Lohr is one of the busiest executives in the country, supervising the operation of two nationwide radio networks with 180 stations. Yet he finds time for eighteen or twenty spare-time interests, which will give him a claim to the title of the world's champion hobbyist!

These hobbies are as amazing in scope as in number. They range from collecting stamps to repairing old guns; from shipbuilding to amateur magic and psychic investigation! The basement of his magnificent home at Tarrytown, N.Y., houses elaborate woodworking and machine shops, besides an electrical laboratory. In upstairs rooms are collections of guns and butterflies, ancient playing cards and mint patterns of U.S. coins. In outbuildings, and in the woods surrounding his estate, this indefatigable hobbyist raises ducks and chickens, pheasants and wild turkeys. The latest addition to his zoo is a pair of black bear cubs from the Maine woods.

More than mere sources of amusement and relaxation, Lenox

Lohr gets fun and relaxation from his skill in magic. He has to master every new trick he sees

Lohr's hobbies are part of his creed of working and living. Original ideas, he holds, seldom occur while a man is working in his office. At a desk, a man considers known facts, analyzes them, weighs them, and draws logical conclusions. Creative, "in-

By KENNETH M. SWEZEY



Not content with running two nation-wide broadcasting networks by day, Lohr spends many evening hours in the electrical laboratory in his home. He is seen making a test of a piece of apparatus



This electrically propelled boat was built by the hobbyist for use on the lake of his estate. At right, he is looking through the glass-bottomed well in the craft that gives a view of fish and underwater plant life

One of Lohr's most unusual hobbies is collecting coin patterns—the "proofs" of proposed designs for U.S. coins struck off for approval. His oldest specimen dates from 1792



spired," ideas, however, spring up under entirely different conditions. Such ideas pop out when the mind is active, but "loosened up," in some unrelated and not too difficult work. The ideal form of this work is a hobby.

"All my original ideas in business or engineering," Lohr states unequivocally, "have come to me while working at a hobby."

A varied and outstanding career has been the outcome of this ability to create ideas through hobbies. Graduated from Cornell in 1916 as a mechanical engineer, Major Lohr has since been soldier, military engineer, topographer, cipher expert, teacher, and magazine editor. In 1928, Rufus C. Dawes persuaded him to take over the enormous job of organizing and running the proposed Century of Progress Exposition at Chicago. Despite the fact that it opened right in the trough of the de-

pression, in 1933, the Chicago fair went ahead under Lohr's guidance to become one of the most successful world expositions in history.

Perhaps the most unusual of his hobbies is his collection of coin patterns. These are "proofs" of designs for United States coins which have been struck off by the mint for submission to judging committees for final approval. They bear the inscriptions of real coins, are made of real coin materials, but are still not legal coins. Patterns in Lohr's collection date back to 1792—a year before the actual opening of the United States Mint—and extend until about twenty-five years ago, when the practice of striking these patterns was discontinued.

Study at Claire College, Cambridge University, England, toward the close of the World War, led to another unusual hobby. "Spirit" writing, table rapping, "materialization" of persons and things from the spirit realm, were at the time being endorsed by Oliver Lodge, Conan Doyle, and others, and were being widely accepted as fact by the masses. To Lohr and his classmates, these phenomena were manifestly fraud. So the entire group began concocting illusions of stage magic that could duplicate all the psychic exhibitions of the mediums. This inquiry led to Lohr's interest in the whole subject of magic.

A reminder of this investigation is



Raising chickens, ducks, turkeys, and pheasants is another diversion. Here he is seen with a pet rooster, Henneypenney. Latest addition to his "zoo" is a pair of bear cubs

a crystal-ball demonstration which Major Lohr still occasionally gives to friends. The seance begins in total darkness. Soon the crystal ball begins to glow with pale, colored light, which weirdly illuminates Lohr's face, as he gazes intently into it. The light constantly fluctuates, and changes color. Solemnly, the crystal gazer forecasts the



PRODUCES HIS OWN MOVIES

Making and projecting home movies is another avocation. Above are three of the projectors with which he exhibits his films in a tiny theater, at left



Stamps are one of his oldest hobbies. He insists on absolutely perfect specimens. At bottom of page he is seen with his collection of playing cards of all varieties

future to his amazed audience.

The whole show is, of course, sheer trickery, and is given merely to prove how easily credulous people may be fooled. The ball is mounted on a black wooden box, containing small dry cells connected to three tiny lamp bulbs of different colors, which throw light on the ball through a hole in the box. By manipulating concealed rheostats, the color and brightness of the ball may be constantly changed. The illumination from the ball is enough to enable the gazer to scan



Lohr started collecting butterflies many years ago as a means of getting outdoor exercise. Today he has a large, scientifically arranged collection of which any amateur could be proud



already-prepared readings, stacked behind the base.

Boats, little and big, form one of the earliest and most deep-rooted of Lohr's hobbies. These give him a chance to exercise both his designing ability and his manual skill.

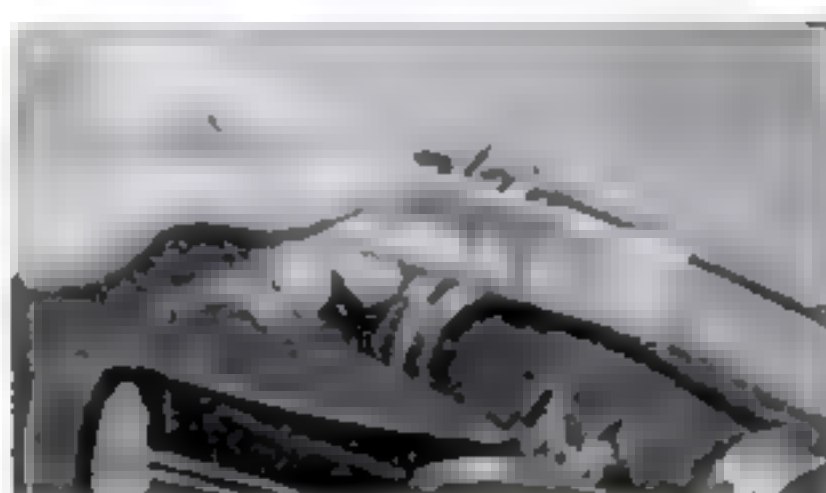
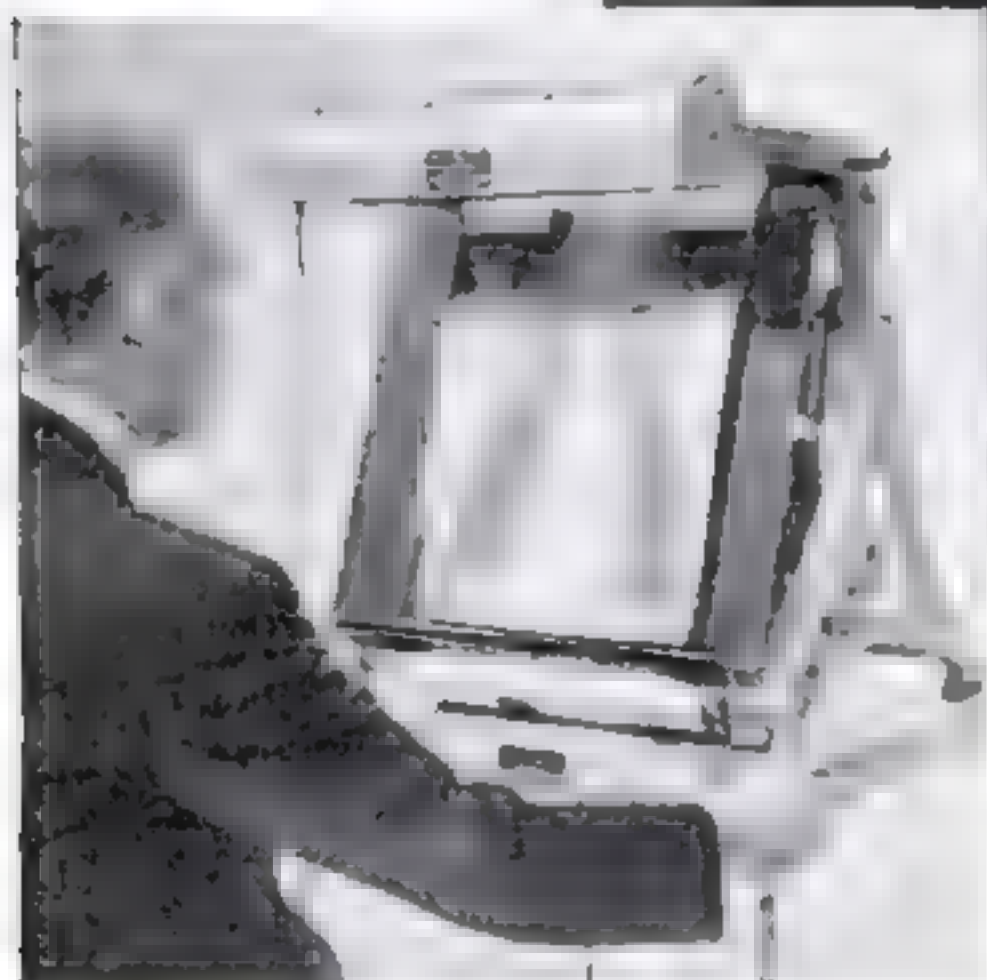
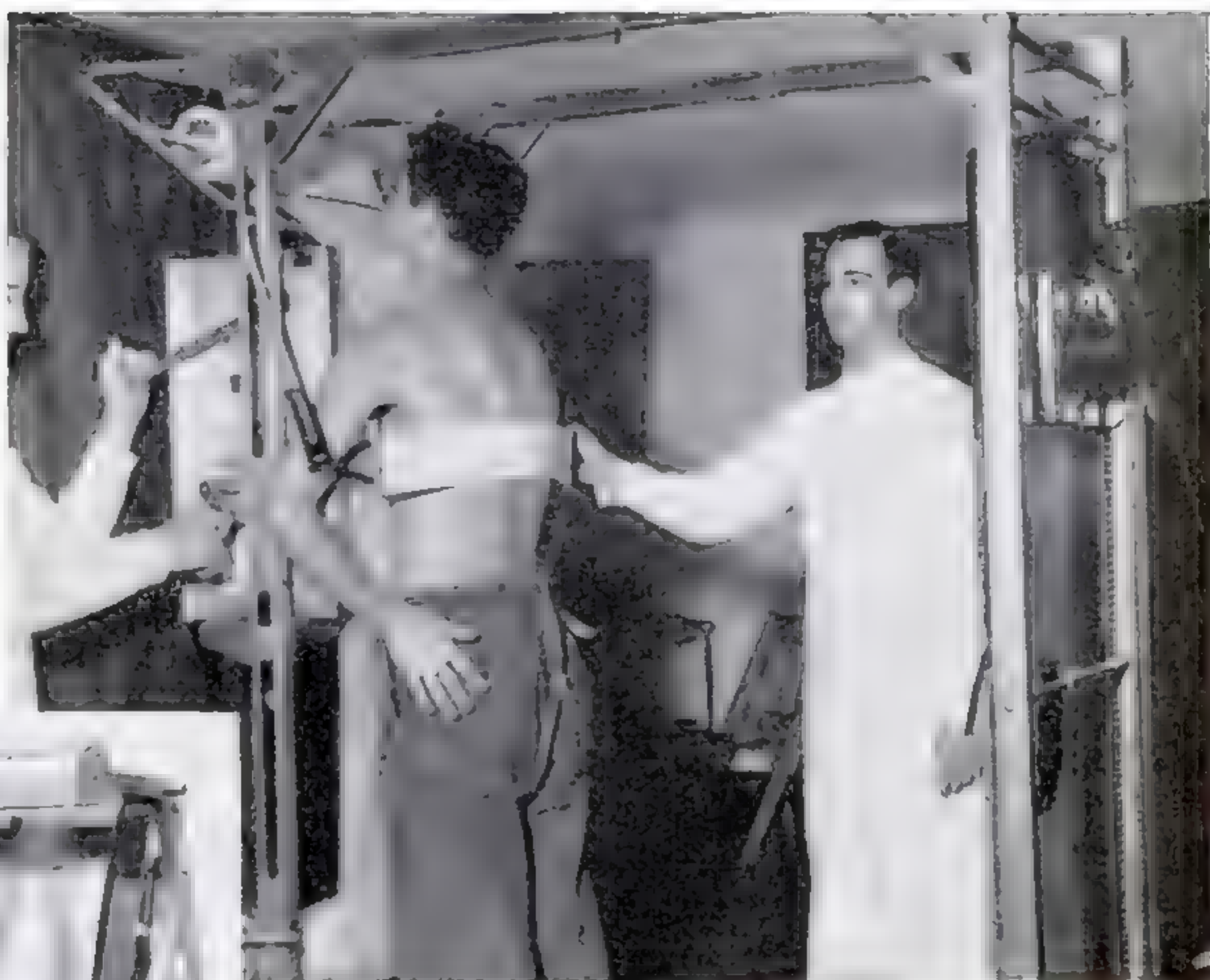
For the private lake in front of his home, he built a noncapsizable, electrically driven boat with a glass panel in the bottom, through which his children and visitors can see the fish and plant life in the water. His biggest boat was a thirty-five-foot cruiser, which he bought partly framed and finished himself.

One of the most up-to-date hobbies of this superhobbyist is the taking and projecting of moving pictures. Realizing the pleasure that might be derived from taking amateur movies, he first imported a thirty-five-millimeter camera from Europe, nearly twenty years ago. Today he has six cameras and four projectors, besides a regular miniature movie theater in his basement. He takes pictures in color and with sound, and when he goes "on location" he carries 200 pounds of equipment. Recently he filmed a home-talent version of "Robin Hood," writing the continuity himself, arranging the scenes, and using his family and friends for the cast!

Low-Cost X-Rays Made on Paper

This portable X-ray machine can make a picture of a subject's chest in twenty seconds, and at a very low cost

Developed X-ray photographs are studied and interpreted by an expert radiologist, as below



Identification of a picture is made positive by a lead stencil. At the right is a sample photograph



X-RAY photographs of the chest, clear enough to indicate the faintest trace of heart disease or tuberculosis, can now be taken at greatly reduced cost, by means of a new machine that substitutes rolls of sensitized paper for expensive X-ray film. With this new device, examinations of more than 500,000 school children, college athletes, policemen, firemen, and factory and office workers, have already been made, and doctors have the first mass statistics on the prevalence and course of these diseases.

Instead of being strapped to a table, the person to be X-rayed merely steps into a booth. A magazine containing a roll of paper long enough for 150 pictures is quickly lined up with his chest, and a lead stencil, bearing his name and other identification, is fastened in the corner. The voltage across the X-ray tube is set according to the chest thickness, the tube flashed for a tenth of a second, and the job is finished.

The sensitized paper rolls are loaded and unloaded through a cloth "darkroom" attached to the machine. Whole rolls are developed as units, and individual pictures are not cut apart until they have all been interpreted in a "reading machine." In this machine, each picture is studied by a radiologist, who writes his interpretation directly on the paper. The pictures are finally cut apart and mailed to the physician designated by the person X-rayed.

Catapult Hurls Man into Lake

FLYING through the air with the greatest of ease is no trick at all to Walter Bura, of West Orange, N. J., who designed the man-throwing catapult shown installed on the boardwalk of Lake Mohawk, Sparta, N. J. Modeled after ancient Roman military types, Bura's catapult has an open steel framework, arranged with a steep take-off ramp on one side. Airplane shock cords fastened at the base run up over pulleys and are stretched taut to a sled at the bottom of the take-off ramp. Placing a loose board under him, Bura lies flat on the sled and is hurtled up the incline and out over the water when a trigger mechanism is released. The board protects his body from chafing as he flies off the sled when the latter comes to a sudden stop at the top of the incline.



Walter Bura tries out his man-throwing catapult. At right, he is ready for the trigger to be pulled; in circle, the sled hits the top of the incline. Above, Bura flying through space



Seven-in-One Golf-Club Kit

ONE shaft and seven detachable club heads housed in a lightweight canvas kit replace a whole golf bag full of heavy clubs, in a novel plan devised by a group of Chicago, Ill., golfers. In addition to the various screw-on club heads, carried conveniently in specially designed pockets, the canvas kit provides a compartment for golf balls and one for wooden tees. Five iron and two wood heads are included in the kit, which is said to be considerably lighter than a conventional bag of clubs.



Changing clubs with a new golf kit is simply a matter of screwing a different head on the shaft

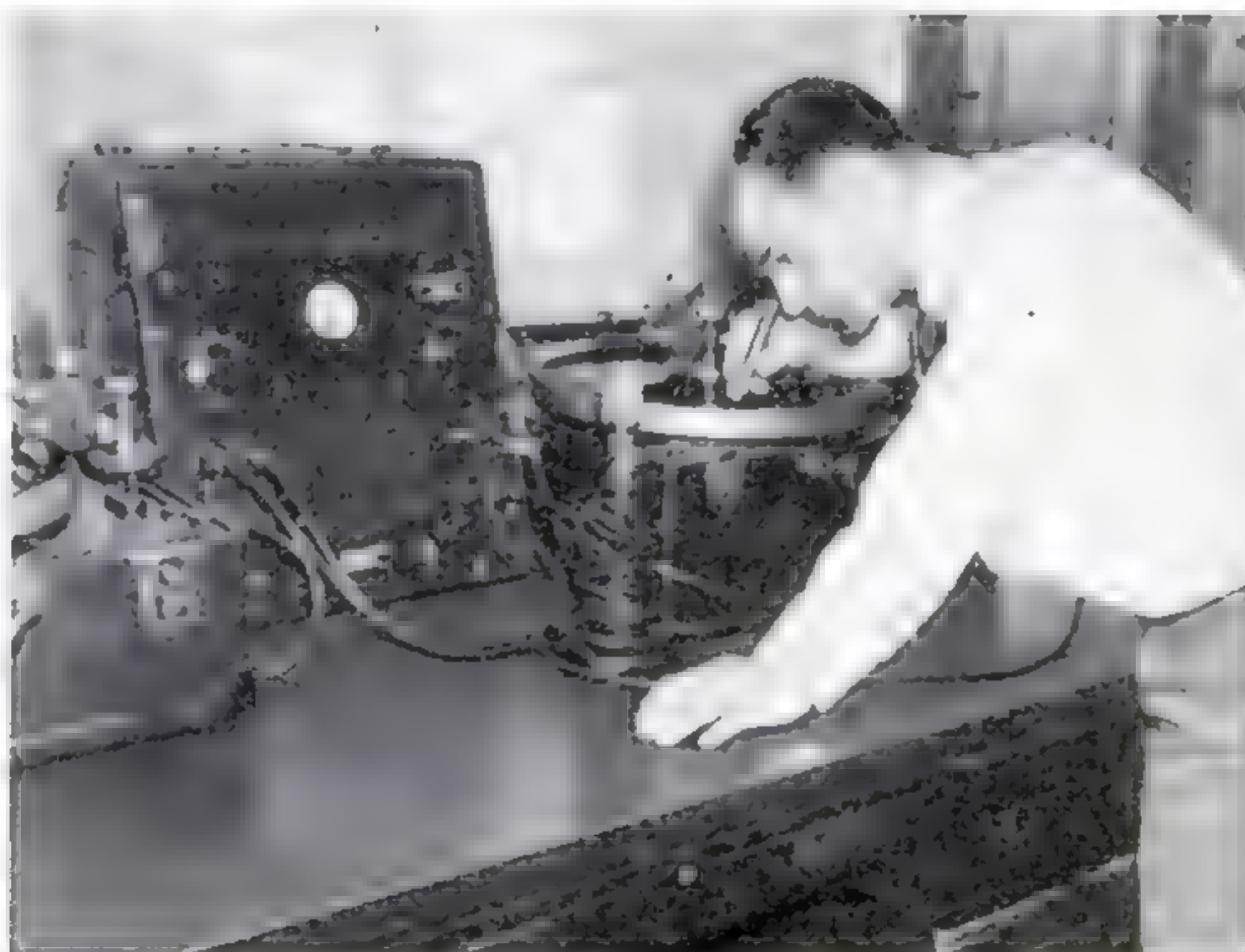
Tool Cleans Paint Brush by Whirling

PAINT brushes are cleaned quickly by means of a new electric whirling device. A brush is first dipped in a cleaning solvent, and then attached by its handle to the whirler, as shown at the left. When the motor is switched on, the brush whirls at high speed, paint being automatically removed by means of centrifugal force.



How Radio G-Men Police the Air Waves

POLICING the air waves is the queer job of the "radio G-men," inspectors of the Federal Communications Commission. At monitoring stations located in seven cities, they listen in continually to see that amateur and commercial stations stick to the frequencies assigned to them, track down unlicensed "bootleg" stations, record questionable broadcast programs, and check commercial programs to see that technicians are keeping their signals "sweet." At the right, an inspector is operating a recording machine in the monitoring station at San Pedro, Calif.



An inspector of the Federal Communications Commission operating a recording machine at a monitoring station to "can" a questionable program

Barrel Exerciser Rolls Away Fat

EXCESS fat on any part of the body can be removed easily with a novel electric massaging barrel, according to the manufacturer. Supported by a metal frame, the barrel, fitted with closely-spaced wooden rollers free to turn, is rotated by a small electric motor that operates on 110 volts A.C. or D.C. Users may sit on the device, lean back against it, straddle it, or lean forward over it, depending on the part of the body to be massaged. Three separate actions are claimed for it: a massage action to stimulate the skin and rub away dead surface tissue, a rolling action to break down fat tissue, and a vibratory action to tone up the system generally.



In use, an electric motor turns the roller-equipped barrel

Massaging legs to reduce fat with the new exerciser

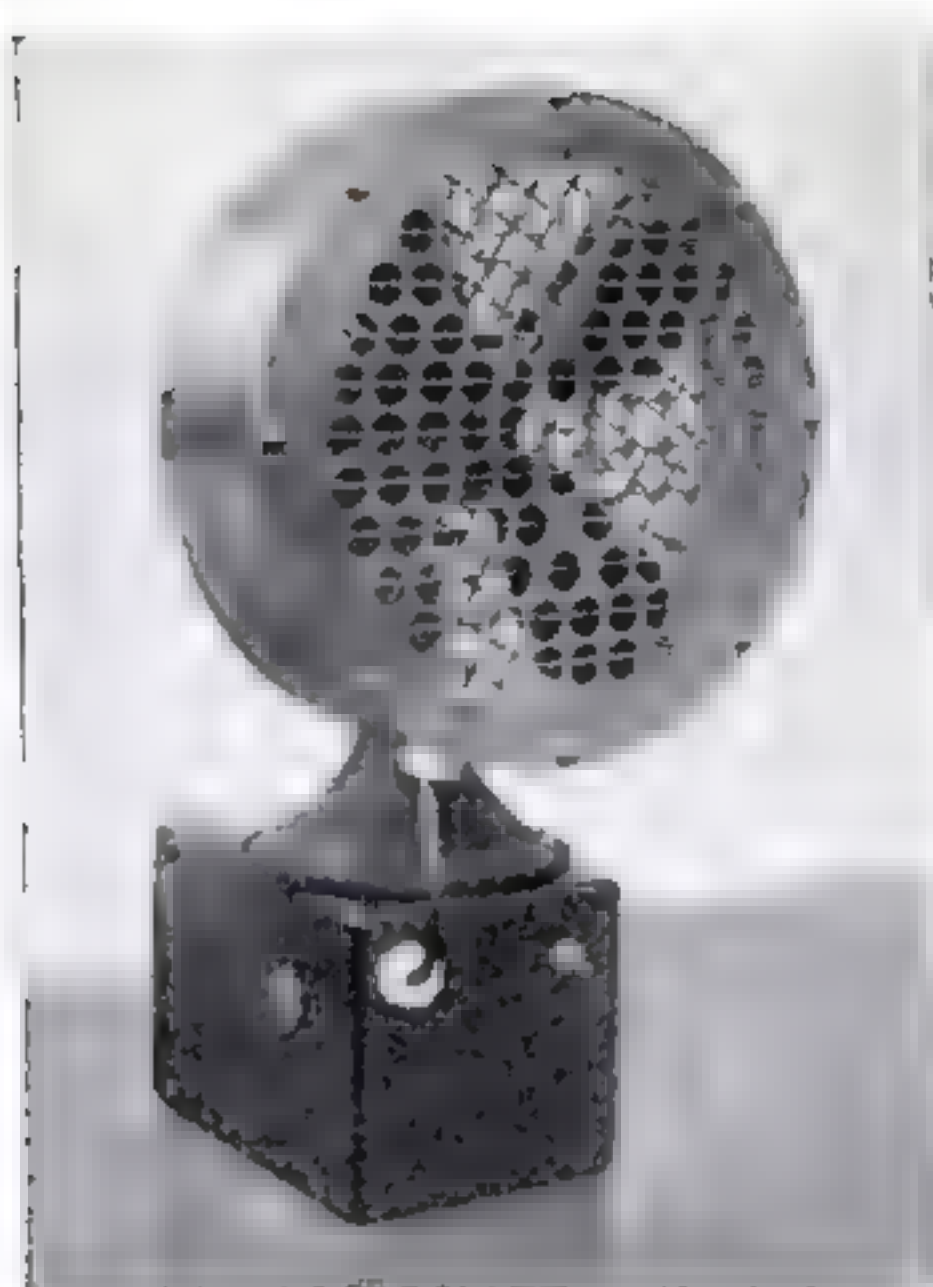


Tin-Can Model Plane Is Built to Scale

DISCARDED coffee cans provided the raw material for a novel model airplane constructed by John Magarine, Brooklyn, N.Y., model-plane enthusiast. Built to scale, the ship patterned after a Korben "Super Ace" has a complete set of controls and lights, rubber tires on its landing wheels, and even an engine radiator that is cooled by water. Fuel tanks are installed in the wings, which have a span of four feet. The model craft is three feet in length and ten inches high. Coffee tins cut into strips, rolled into tubes, and welded at the seams form the fuselage framework of the sturdy but graceful ship, while sheets of the tin were used to cover the fuselage and wings.



Coffee cans provided the materials for this remarkable model plane



Fan Ionizes Air To Counteract Danger of Static

STATIC electricity, the cause of many explosions in rooms where inflammable or explosive vapors are present, is counteracted by the novel ionizing electric fan pictured in the photograph above. Ionized air, either positive or negative, is created in front of the fan blades, which spread it throughout a room to counteract dangerous concentrations of static.

Air Sweeps Dust off Home Plate

BASEBALL umpires can throw away their whisk brooms if an automatic home-plate duster recently invented is generally adopted. When the device is placed in operation, a valve built into the plate rises and a blast of compressed air sweeps it clean of dust and dirt, as shown in the photograph below.



A valve rises from the plate and emits air to blow away the dust

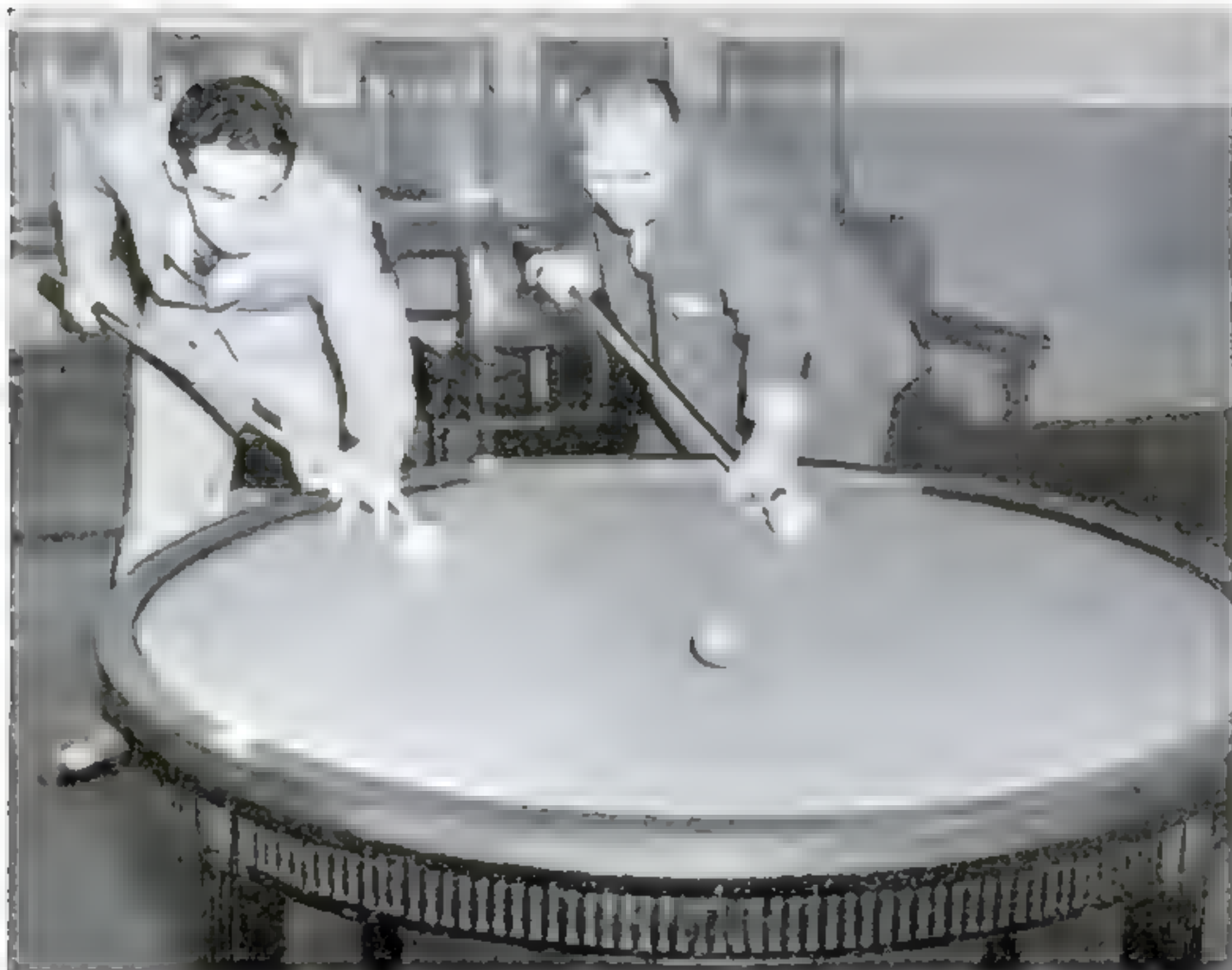


O. A. Baker demonstrating his safety 'chute. Note the "pressure dome"

Novel Parachute Opens Quickly

LEAPS from airplanes flying as low as seventy-five feet above the ground are said to be made safe by a new parachute invented by O. A. Baker, of El Monte, Calif. The secret of the new safety parachute, which is so designed that it will open immediately after the rip cord is yanked, is said to be a "pressure dome," a small 'chute within the larger one, which, the inventor claims, permits active air circulation and insures instant opening of the fabric. It is being demonstrated in the illustration at the left.

Round Table Puzzles Billiard Circles

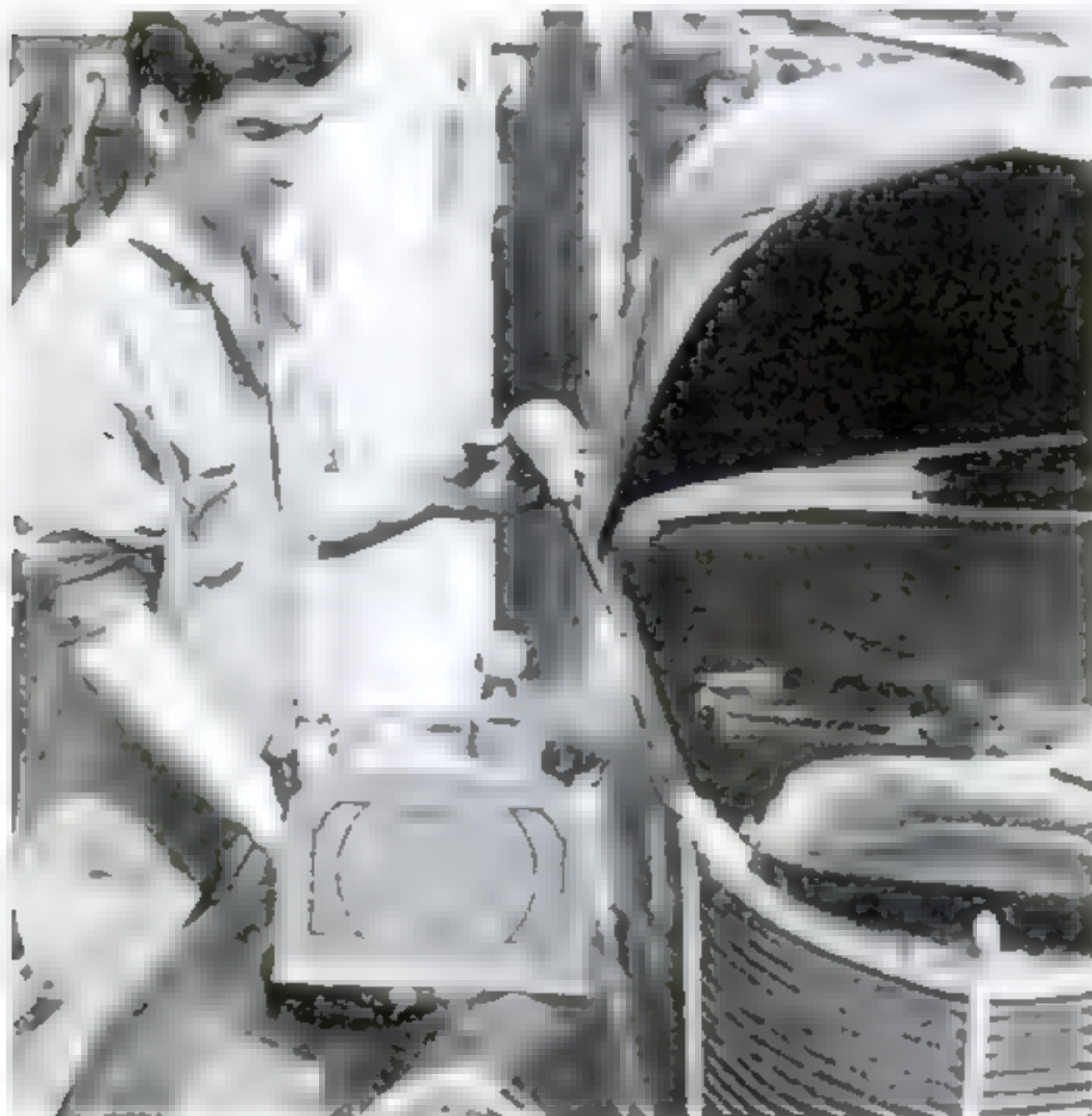


Fred Waring and Willie Hoppe square off for play on a round billiard table

WILLIE HOPPE, billiard champion, thought he was going to be made the butt of some practical joke when he accepted an invitation from Fred Waring, orchestra leader, to play a game on the latter's "round" billiard table. Believing that a round billiard table was in the same class as a vertical football field or an underground baseball diamond, Hoppe brought along a batch of square billiard balls as his contribution to the merriment. However, the odd billiard table proved to be actually round, as the picture at left shows.

Rubber Battery Servicer Can't Mar Car's Finish

ESPECIALLY handy for servicing storage batteries located under the hoods of cars, a kit recently marketed holds a gallon of distilled water and provides compartments for the various battery tools. Made entirely of rubber, the unit will not scratch a car's finish nor break if the water in it freezes. In addition, it is not harmed by acid.



This kit can be rested safely right on a car fender

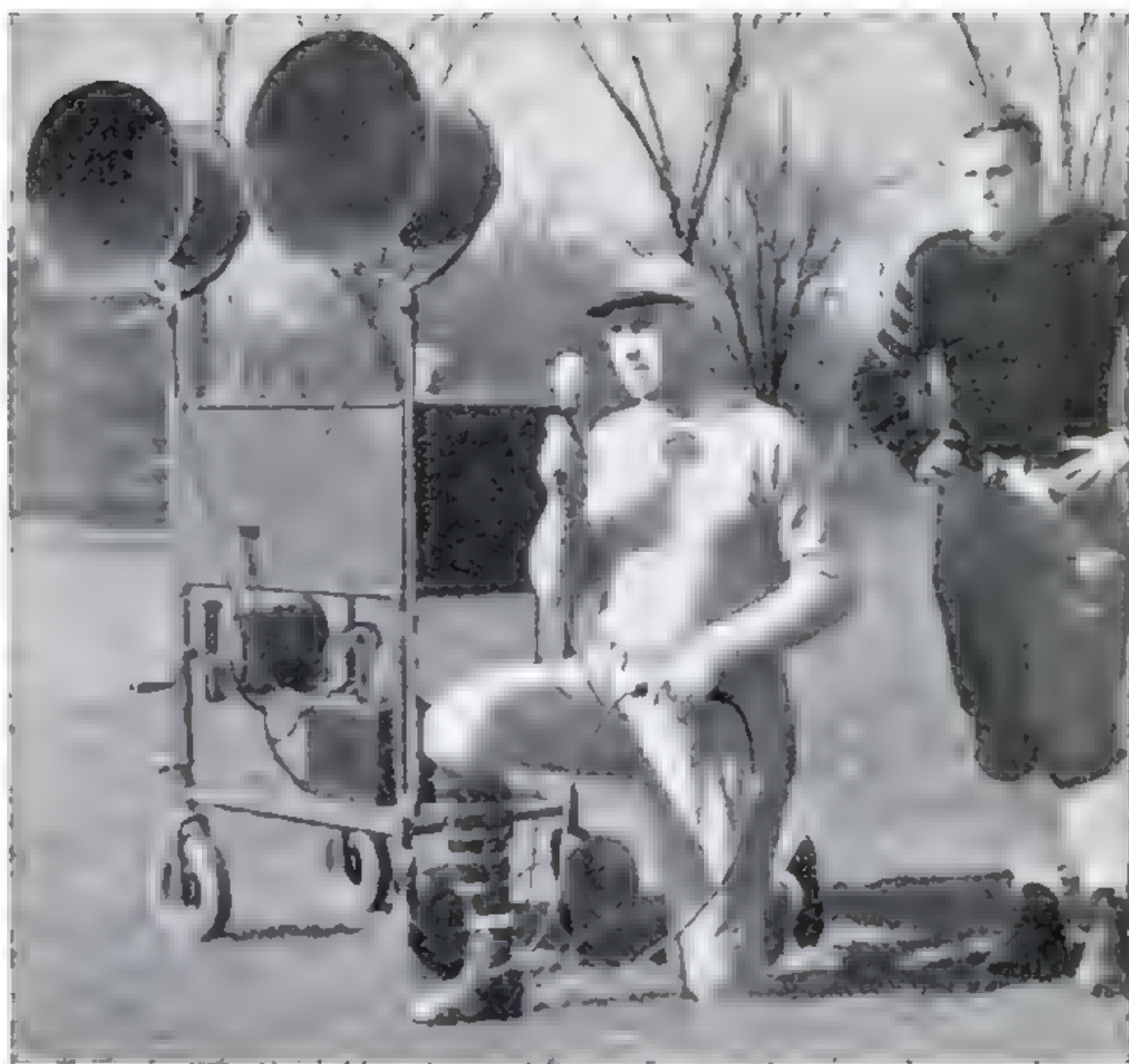


Cattle Get Headlights—Horns Standard Equipment

AFTER several of his livestock had wandered onto dark country roads at night, and been killed by passing automobiles and trucks, an English farmer solved the problem by providing head and tail lights for his cattle. Tiny lamps powered by small dry cells are affixed to the horns and tails of the animals, making them visible to motorists coming from either direction along the roads that border the farm. In the photograph above, one of the tiny headlamp-and-battery units is shown strapped to the horn of a steer.

Football Coach Directs Squads by Loudspeaker

TO MAKE his voice heard in every part of a broad practice football field, coach Tad Wieman, of Princeton University in Princeton, N. J., has adopted a mobile field loudspeaker system, which he is shown using in the photograph at the right. Wheeled out onto the sidelines, and placed in an advantageous position, the battery-operated public-address unit makes it possible for the coach to direct the practice of several squads working in different parts of the grid-iron without having to walk back and forth.



Coach Tad Wieman instructing players through his loudspeaker unit

Hobbyist Fashions Cigar-Butt Army

MAKING comic toy soldiers from cigarettes, cigar butts, and other smokers' materials is the odd spare-time occupation of the hobbyist pictured at work in the photograph below. Products of his unusual craft include buck privates made from painted cigarettes, with paper-match arms and burnt-match facial features, a can-

non made from a cigarette holder, a commanding officer in the shape of a cigar butt with paper-match medals and decorations, and a handsome steed fashioned from a pipe and outfitted with four cigar-butt legs.



They're in the Army now: cigarettes, pipes, cigar butts, and other smokers' articles made into comic military figures by the hobbyist seen at the left

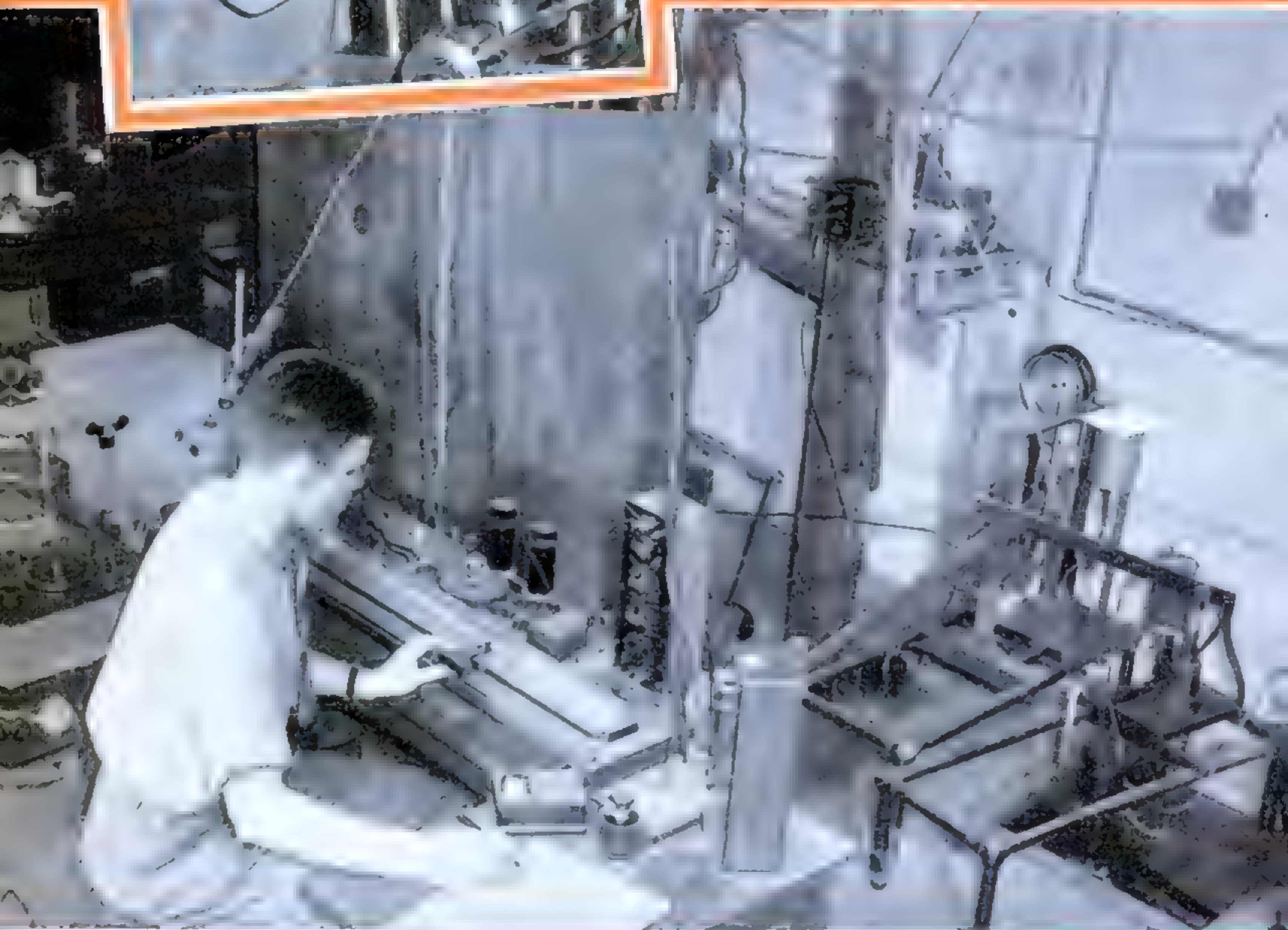


High-pressure "bomb" (below the operator's hand) in position in the hydraulic press, set for an experiment

High-Pressure Tests

PRESSURES up to 2,000,000 pounds to the square inch—the greatest one-directional stress ever controlled and measured in laboratory research—are being applied to rocks and crystals at Harvard University, in experiments which are yielding clues to the mechanism of earthquakes, mountain formation, and other geological phenomena deep underground.

Conducted by David T. Griggs, these experiments make use of the high-pressure apparatus developed by Prof. P. W. Bridgman. Pressure conditions in any part of the earth's outer crust—a granitic layer extending down thirty to fifty miles—are faithfully reproduced. In some of the tests, temperatures as high as 900 degrees F. are combined with the pressure. Under high pressures the strength of rock changes, and in many cases



From his post at the electrical control tables, a research worker applies tremendous pressure to a sample of rock

Show How Rocks Were Made

hard rock flows without breaking, like metal.

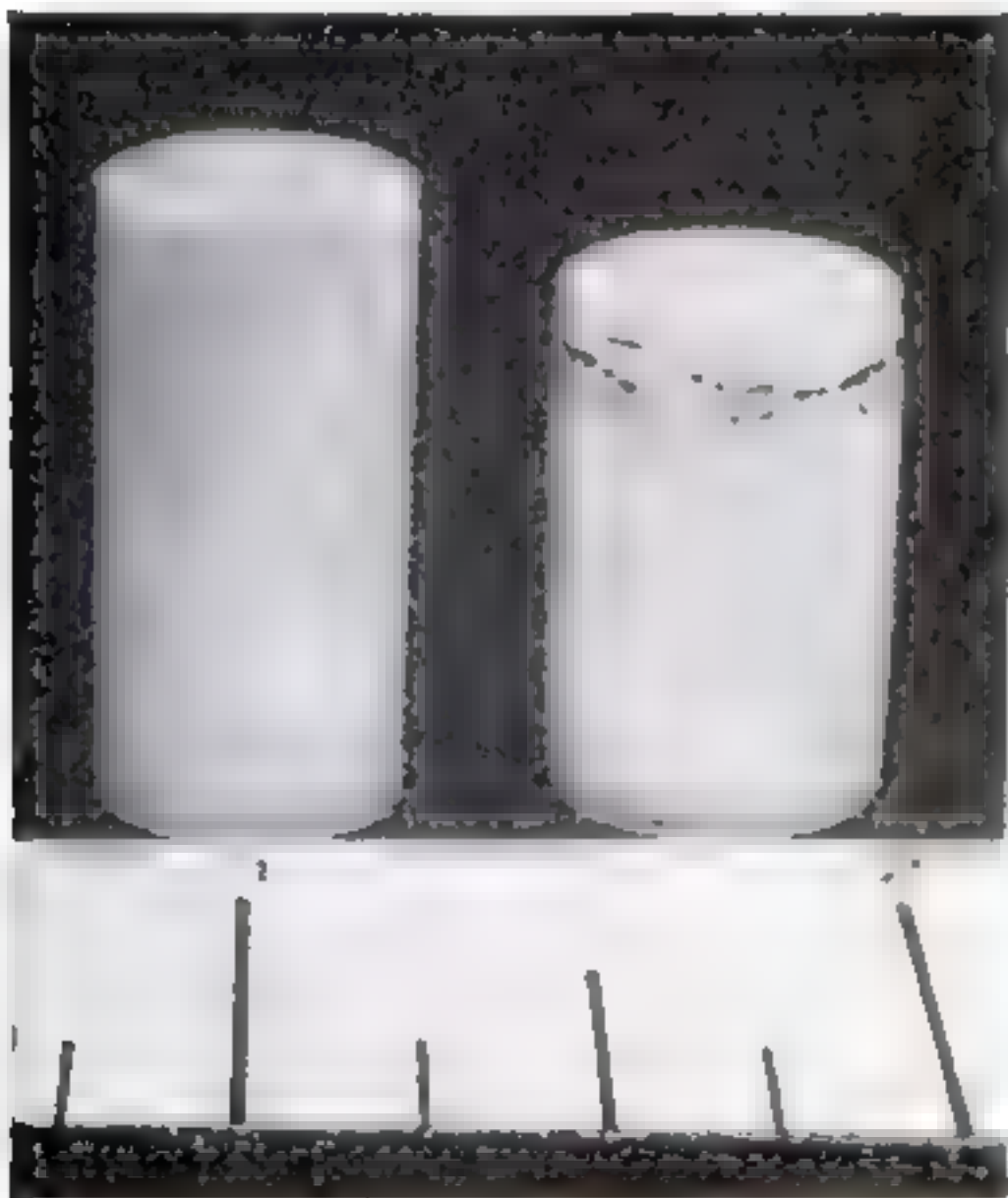
Because the apparatus is used right up to the limit of strength of the special alloy-steel piston which applies the pressure, the experimenter works behind a shield of thick boiler plate, observing his instruments by means of a small telescope aimed through a hole in the plate. Occasionally a piston bursts, with the force of an explosion.

A specimen of rock to be tested is placed in a thick steel cylinder, or "bomb." Under pressure applied merely between the ends, the rock might fracture and crumble easily. A hydraulic confining pressure, simulating the pressure on all sides of a rock deep in the earth, is therefore applied in addition to the differential pressure. It is produced by forcing liquids—or for very high pressures, lead—into the cylinder.

A clue to the causes of rock deformation that may have resulted in the creation of mountains, may be found in the discovery that high confining pressure makes limestone far more plastic, and completely changes its characteristics of flow. Under a confining pressure of 150,000 pounds to the square inch—equivalent to a depth of twenty-two miles underground—a limestone cylinder



A rock specimen inside a "bomb" that exploded



Marble cylinder before (left) and after receiving pressure equal to that far underground

Observations are made, as at right, through a hole in the boiler plate that shields the operator from bursting "bombs"





Creep testers, in which specimens of rock are subjected to smaller stresses applied over long periods of time, in some cases even for several years

der was compressed thirty-five percent in length without shattering. At this pressure, limestone, which is a very compact, strong rock, actually flowed a little more than

marble, a relatively weak, loosely compacted rock.

Clews to the nature of deep-focus earthquakes have been found in studies of rock fracture under these high confining pressures. Two of the findings are contrary to past geological beliefs. Although many rocks are capable of being squeezed to a remarkable degree without breaking, there is a definite limit to this deformation. When this limit has been reached, fracture may occur suddenly. Furthermore, a sudden stress is not necessary to break the rock, when the confining pressure is high; a strong and steady pressure will cause a fracture, if applied long enough.

On the other hand, the tests confirm geological evidence that the earth's crust at the surface is very strong and will not flow under small stresses even when applied over a long period. In a test of the creep of rocks under surface conditions, one specimen of limestone was subjected to lengthwise pressure of 22,000 pounds to the square inch for over a year. The results indicated that a limestone block loaded to half its breaking strength for 10,000 years would deform only one percent. The Harvard equipment can measure changes of one ten-millionth of an inch.

Other substances in which flow has been observed in the laboratory include glass, rock salt, calcite crystals, talc, shale, and marble.

Hood Squelches Incendiary Bombs

INCENDIARY bombs, believed to be one of the greatest hazards in large-scale aerial attacks on big cities, may be rendered less destructive by a device demonstrated recently in Paris, France. As shown in the illustration at the right, a metal hood containing sand is placed over the sputtering bomb. When the carrying handle is pressed down, the sand is released so that it pours onto the bomb and prevents the spread of the flames. In wartime use, firemen and civilians would be equipped with the hoods for prompt squelching of bombs as fast as they fell.



Filled with sand, this metal hood is placed over an incendiary bomb. Pressure on the handle dumps the sand to prevent spread of the flames

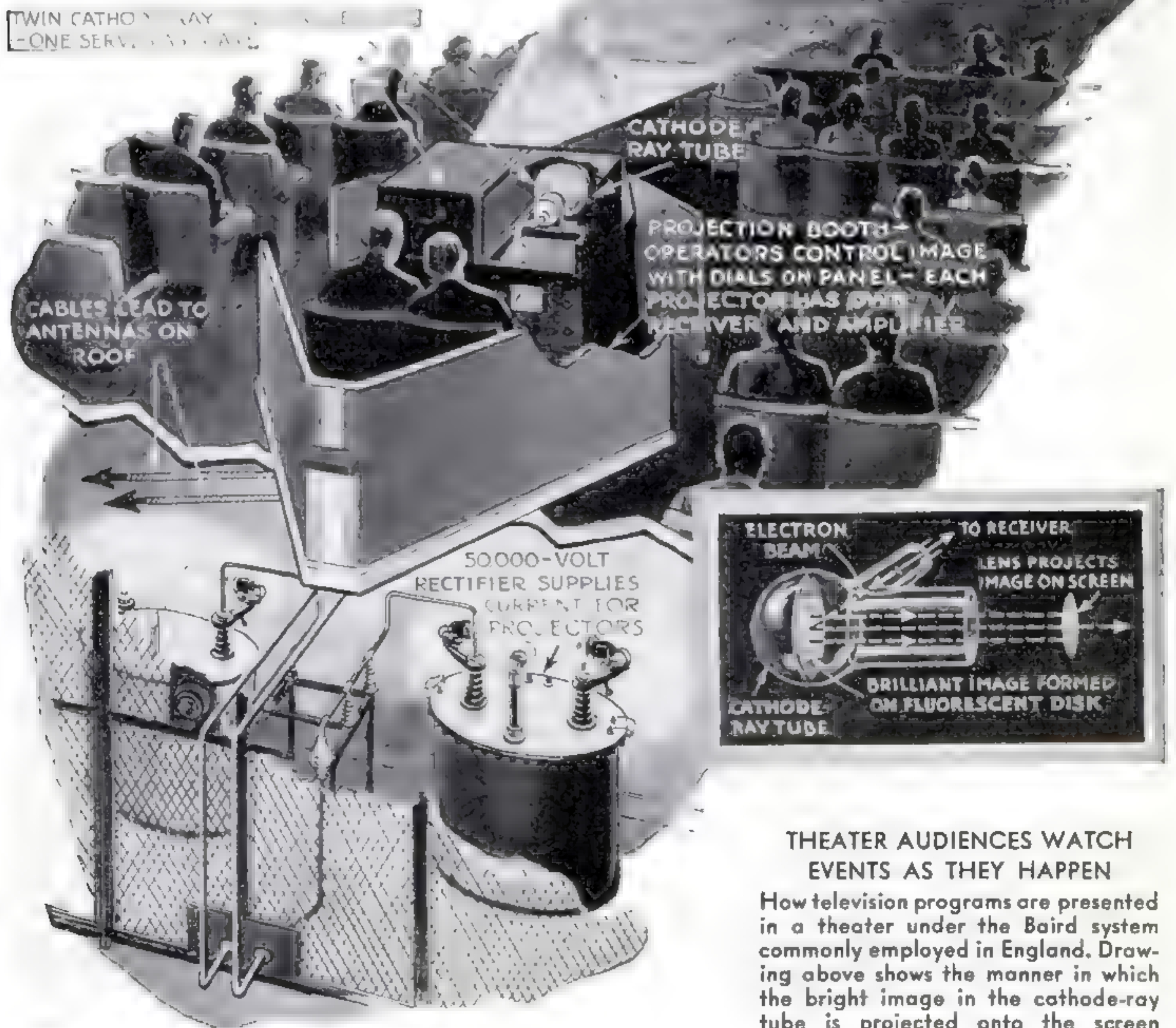
Television Shown in Theaters

TELEVISION in theaters, already a success in England, may soon entertain American audiences. Just opened in a New York office building, a demonstration "theater" exhibits the Baird system used abroad, which throws brilliant images as large as fifteen by twenty feet upon the screen. Installed in a number of British theaters, it offers televised news scenes to supplement regular movie shows, and all-television programs of major sporting events.

Occupying the center of the theater, the projection booth contains all the essential apparatus and controls, except for a special receiving aerial on the roof and high-tension power supply from a 50,000-volt rectifier. One of its two duplicate receiver-projectors serves as a stand-by, in case of tube failure, while the other is in operation. Each set employs twenty-seven tubes, including a

cathode-ray tube of new design, whose intensely bright four-by-five-inch image is magnified by the projection lens. From the same booth, the operator controls the accompanying sound and all stage lights.

TWIN CATHODE RAY
-ONE SERVING AS BACK-UP



THEATER AUDIENCES WATCH EVENTS AS THEY HAPPEN

How television programs are presented in a theater under the Baird system commonly employed in England. Drawing above shows the manner in which the bright image in the cathode-ray tube is projected onto the screen



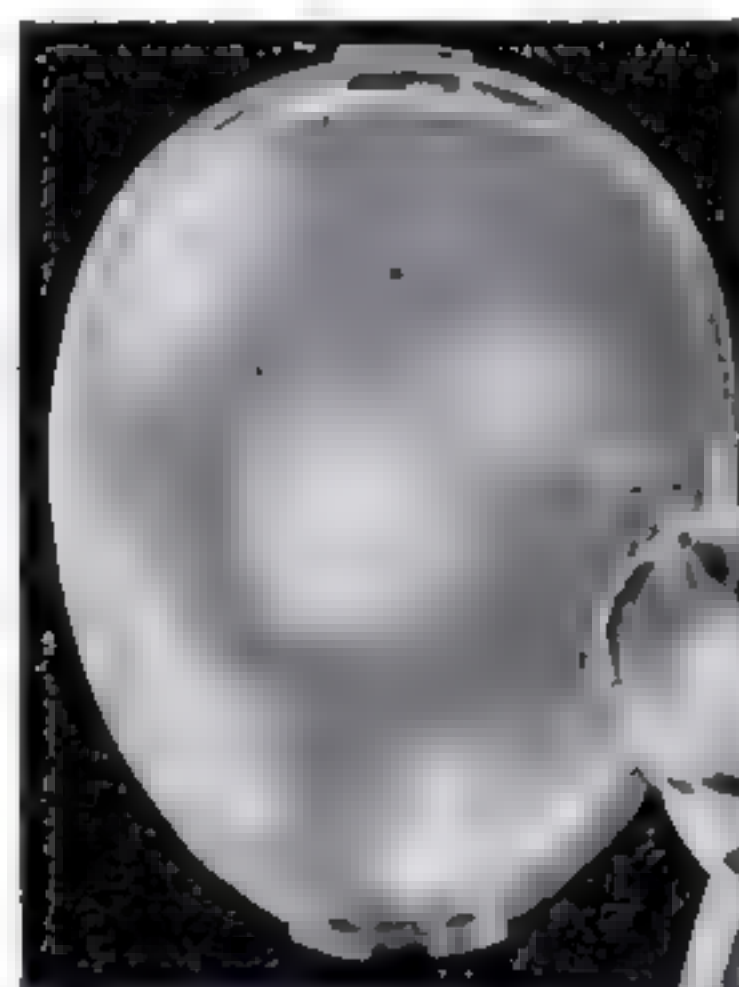
Harbor Bulletin Board Identifies Ships

TO KEEP park visitors abreast of maritime activity around the harbor of New York City, a mammoth outdoor bulletin board has been erected in Battery Park, on the southernmost tip of Manhattan Island, facing the

bay and adjoining the river entrances to New York docks and piers. The arrival and departure schedules of transatlantic and coastal passenger ships are posted daily, with funnel markings for identification.

Headlamp Lenses Tested for Strains by Polarized Light

AUTOMOBILE headlight lenses are now tested by a leading car manufacturer with the aid of a one-way-light instrument which detects normally invisible strains in the glass. New lenses are placed on a viewing screen that is sandwiched between two sheets of polarizing glass. When a lens is viewed through a circular opening in the top of the tester, it will appear an evenly distributed color if perfect. If imperfect, however, perhaps because of incomplete annealing of the glass, the lens will reveal its strains by telltale color streaks.



How a good lens (left) and a defective one appear under test. The blotches show strain areas



Welders at Work Make Striking Picture



Not men of Mars at work, but welders in a steel mill, photographed repairing a broken machine part

LOOKING like fantastic men from Mars squatting around a steaming cauldron of some magic brew, electric-arc welders huddling over a major repair job form the subjects for the striking photograph reproduced above. The particular job on which the men

are pictured working was to repair a vital broken part which caused all operations in a large steel mill to come to a costly halt. By the use of a special welding technique, the mill was placed back in operation within record time.

Table Gives Three Drawing Surfaces

THREE-SIDED rotating drafting tables have recently been developed to save space and increase working efficiency in a large engineering drafting room. Plans and drawings can be tacked to any one or all three sides of the table, and, simply by releasing a pedal, the desired drawing or reference sheet can be turned up in a convenient working position without disturbing drawings attached to the two other surfaces. Developed and built for its own use by a firm manufacturing heavy grading equipment, the rotary drawing boards are said to have resulted in considerable savings. Where twenty-four large drafting tables were formerly required, eight of the new revolving tables now do the same work in only one third the floor space.



A pedal permits the three-sided table to be revolved at will

He Invents for Fun



Fred R. Staudle watching the operation of a holder he invented to save lifting an iron on to an elevated stand

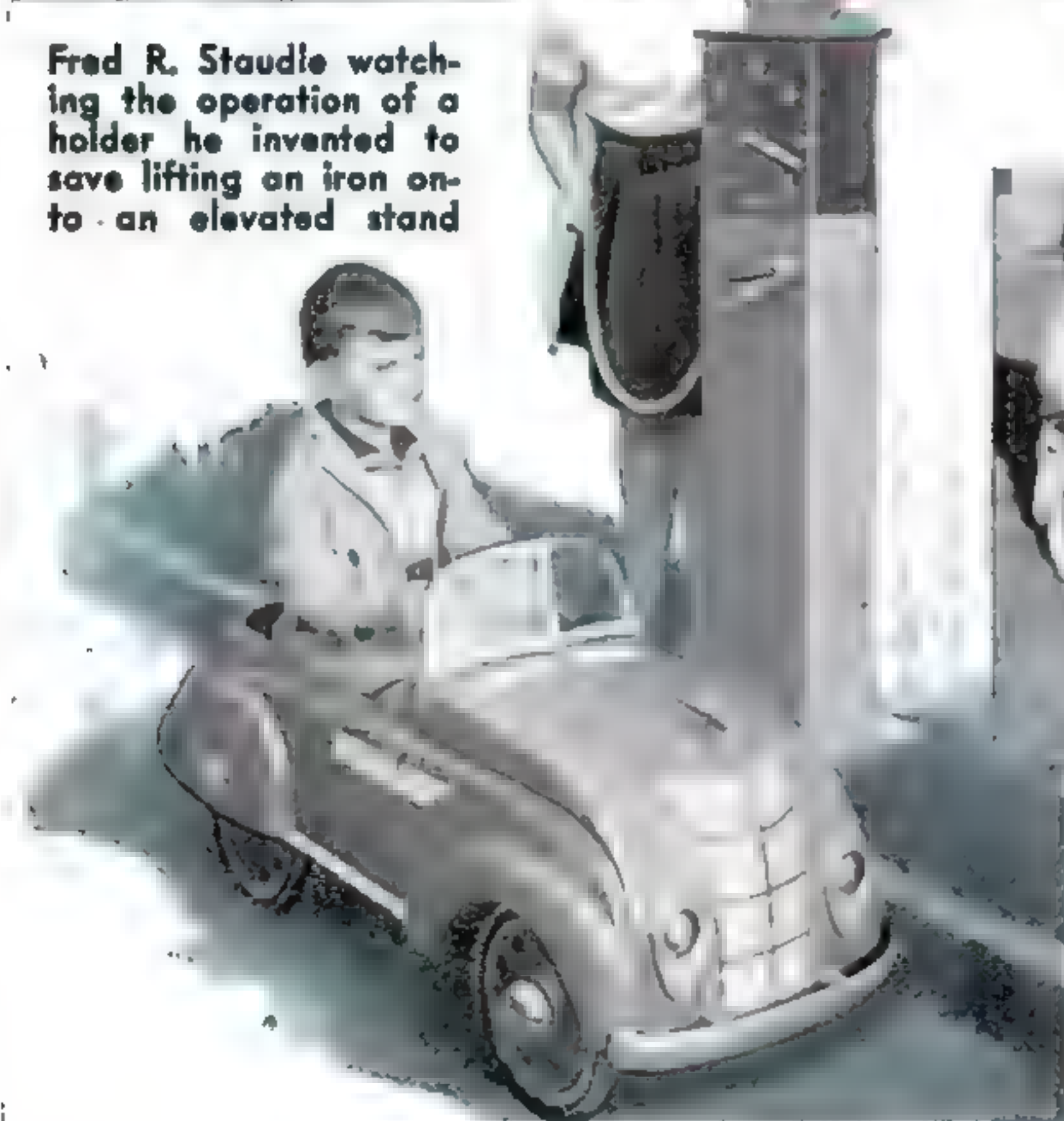
COBBLER, car washer, and now a private chauffeur for a Milwaukee, Wis., banker—those have been the workaday occupations of Fred R. Staudle, who came to this country from Europe sixteen years ago. But after hours he turns to his home workshop and his hobby of inventing things.

He saw a maid, in the household where he works, lifting her iron from time to time and setting it on an elevated stand. One day Staudle snapped an almost flat stand upon her ironing board. With one sweep of her arm, she could slide the iron upon it, and a ridge kept the iron from slipping back. Holes in the side provided air-cooling, and spring clamps would attach the iron rest to a board of any width from ten to twenty inches. A manufacturer took a fancy to the idea and turned out 100,000 of the stands for other women who might tire of lifting heavy irons.

When he spied a neighbor

By

JOHN E. LODGE



Staudle likes to build toys for his friends' children. This is a garage for toy cars, with parking lot above

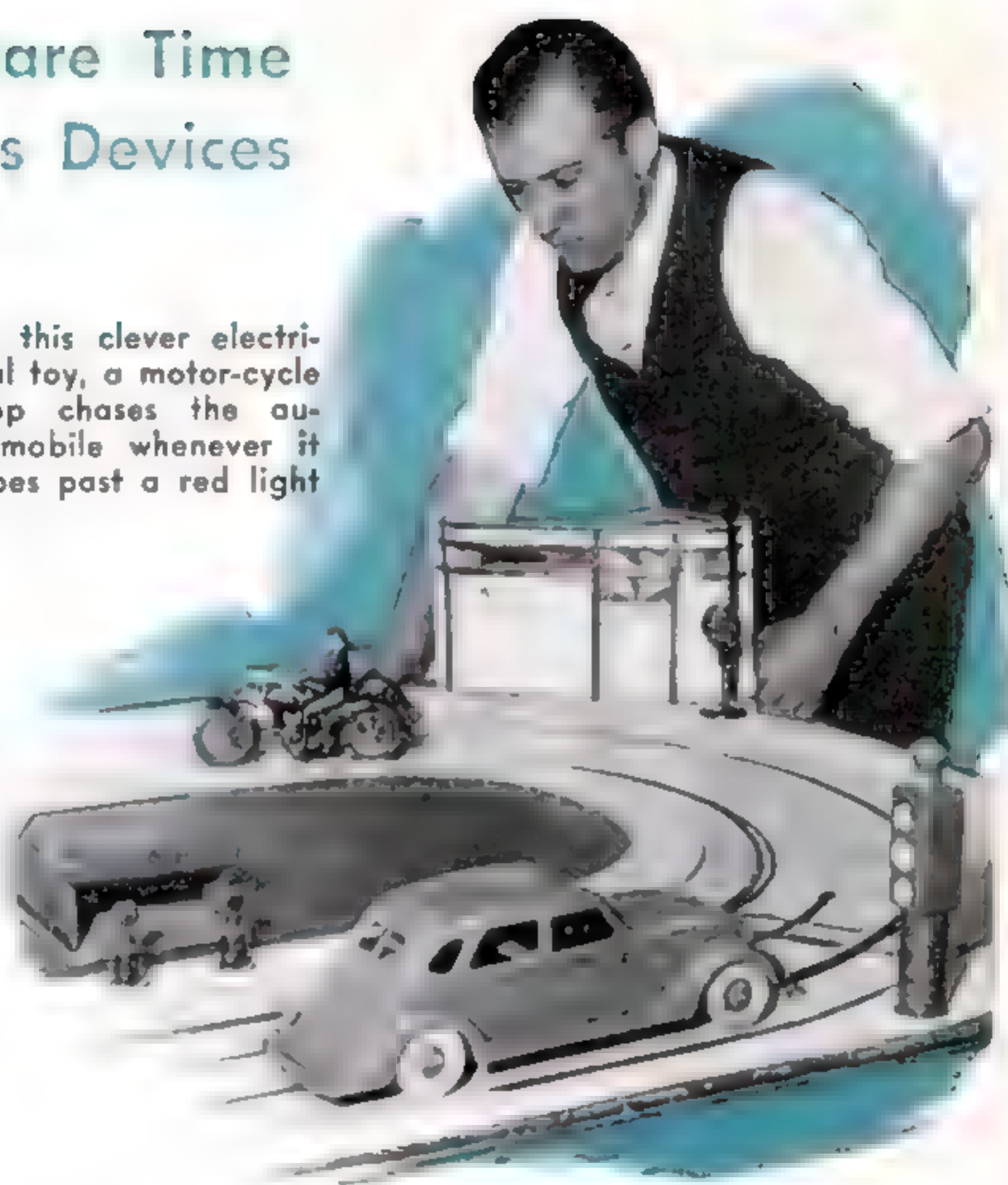
At the left, the same young man is "getting gas" at a pump, made by the chauffeur-inventor. A bell rings for each gallon of imaginary fuel

Chauffeur Spends Spare Time Thinking Up Ingenious Devices

shaking a mop through an open window, contrary to law, Staudle figured that there must be a better way of getting rid of the dust. First he built an ordinary box with a slit in a door at the top, big enough for a mop handle. Then he inserted a series of wooden rods, and a drawer at the bottom. To free the dust from a mop, his wife inserts its business end within the box, closes the top, and rubs the fringe back and forth across the wooden rungs. At her convenience, she empties the dust from the drawer.

Not long ago, the chauffeur-inventor was asked to turn his talents to improving his employer's vacation retreat, a country home on North Lake, Wis. Staudle fashioned rustic bridges with cedar rails and flooring, and built up the approaches with concrete and field stones. More colorful field stones went into an ingenious two-tier grill for broiling wieners and steaks over a charcoal fire. Then Staudle noticed the stiffness of a diving board on a float near the lake

In this clever electrical toy, a motor-cycle cop chases the automobile whenever it goes past a red light



shore. Each time a diver plunged off, the float rolled heavily, to the discomfort of its other occupants. A new board, cleverly cradled by a salvaged auto spring, fixed that.

Staudle is happiest when planning a new toy for his friends' children. Near his home, a neighbor's small boy often pedaled a play automobile, stopping at imaginary filling stations. One morning, Staudle beckoned the sur-



Because a stiff diving board rocked the float too much, Staudle rigged up this board on a discarded car spring



At his boss's summer home, Staudle built rustic bridges and a two-tier picnic grill



prised young motorist to a tall red pump beside the curb. Holding a small tube against the back of the car, the chauffeur-inventor solemnly pumped "gas" into a make-believe tank. With each "gallon," a bell rang, and an arrow revolved realistically to show the total. For the same youngster, Staudle built a toy garage, with a ramp for parking model cars on the roof and a miniature fire engine occupying the space below.

To make what he considers the best of his novelties for children, he built an oval wooden track for a toy automobile that he fitted with an electric motor. A rod connects the

car to guides on the base of the model. When he touches a button, the car speeds around the track, stopping if a red light shows in a model traffic signal, and going on when the light flashes green. If he presses a second button, the motorist goes past the stop light. Thereupon a toy motor-cycle cop dashes out from a police station and gives chase. "Which," Staudle observes from professional experience, "is a lesson many drivers need to learn."

Although he admits to working "just for fun," this chauffeur-inventor has a knack of always turning out something that will be of value to some one.



No need to shake a mop out the window if you have this handy device. Closed in the box, the mop head is rubbed on dowel rods to loosen the dust, which drops into the drawer at the bottom for easy removal

High-Speed Photo "Stops" Leaping Toad



Like a living bullet, the horned toad is pictured in swift attack on a cricket

STRIKING with lightning speed, the horned toad pictured in the remarkable photograph at the left is shown hurtling its body through the air in a bulletlike leap for its prey, a cricket. Poised on some high vantage point, the toad waits until its prey is within easy striking distance, and then leaps directly at it with a speed that makes its movement only a blur to the unaided eye. This photograph was made with a high-speed camera at an exposure of 1/1,500 of a second, and under extremely bright light.



New Golf-Bag Stand Opens Automatically

GOLF BAGS equipped with an easily attached automatic stand rest at a convenient angle for the removal or insertion of individual clubs. When the bag is stood on the ground by the golfer or his caddie, a rubber-tipped extension at the base of the bag forces two metal standards to spring outward to hold the bag so that the clubs are accessible, as shown in the photograph reproduced above.

Wrench Frees Tight Lug Nuts

"FROZEN" lug nuts on automobile and truck wheels are easily loosened and removed with the aid of a "sledge-hammer" wrench now available. The weighted handle swings in an arc of 100 degrees or more before raised lugs on the shaft check it, imparting a blow to loosen the nut.



A twirl of the handle loosens a nut. Extra weights as at left may be added if needed



Engine Runs on Acetylene with New Carburetor

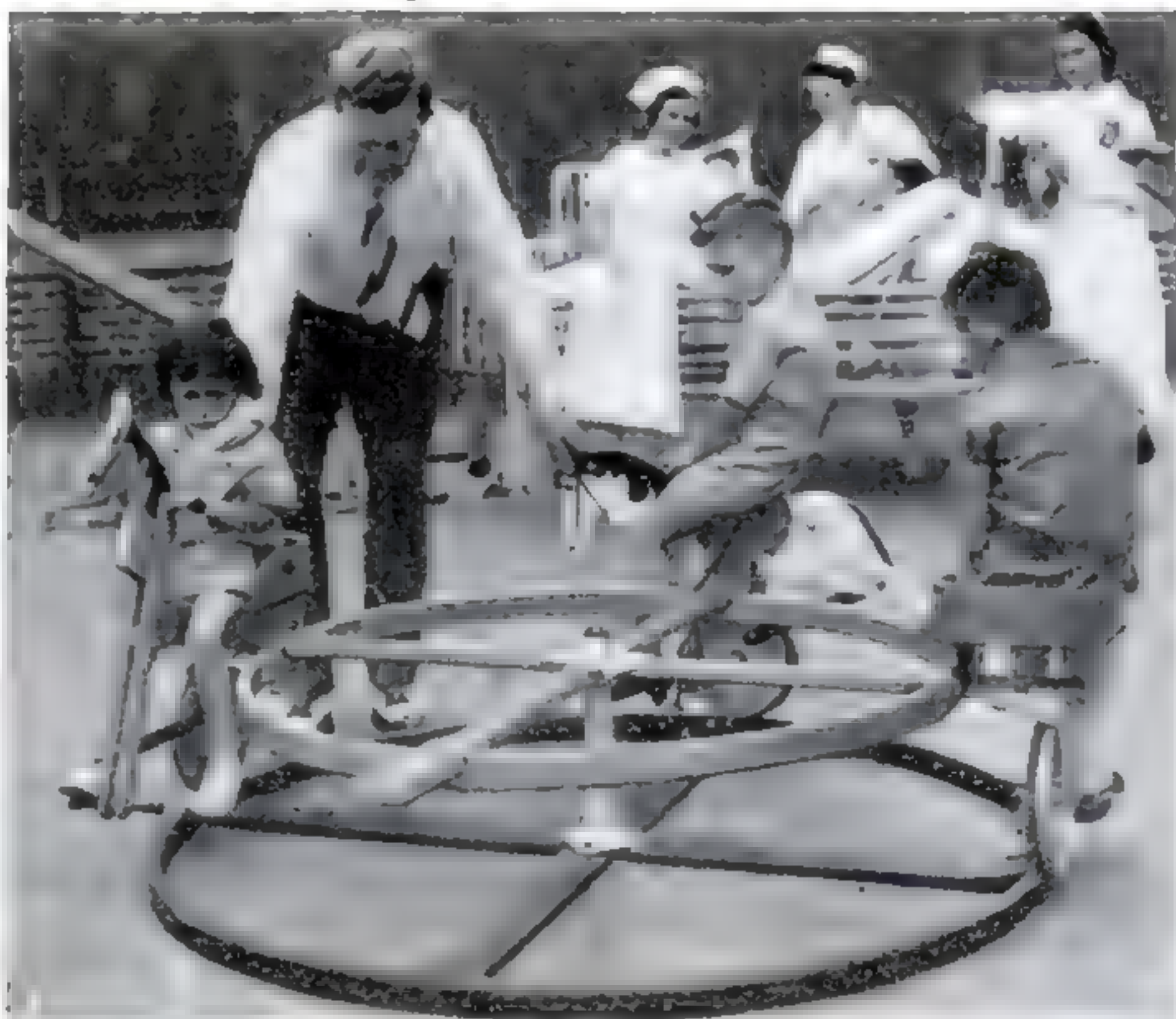
RUNNING an internal-combustion motor on acetylene, a gas generated from calcium carbide and water, instead of on gasoline, is made possible by a special carburetor perfected after seventeen months of experimental work by Herman Pederson, of Brooklyn, N. Y. The device employs a pair of small propellers to provide a constant gas pressure, and special graduated supply lines to increase the pressure of the gas before it enters the engine cylinders. In a laboratory test, Pederson states, a motor equipped with this carburetor ran for two hours and thirty-five minutes on acetylene produced from fuel that cost only twenty-three cents, compared with a run slightly more than half as long when the motor operated on a gallon of gasoline that cost eighteen cents. Pederson believes that his carburetor will ultimately make acetylene replace gasoline as a motor fuel.



Engine equipped to burn acetylene, with gas generator in the background. The special carburetor is seen in the smaller photograph

Merry-Go-Round Helps Child Invalids

HOBBYHORSES on wheels, running on a circular track, form a novel merry-go-round for patients in a special children's ward set up in New York City's new Memorial Hospital for the treatment of cancer and allied diseases. One-wheel hobbyhorses and chairs run around a circular track resting on the floor, and are supported at the side by attachment to a circular wooden framework that turns on a central metal column. Power is provided by the children shifting their weight on the hobbyhorses, while those in chairs pump levers resembling horses' heads, as illustrated in the photograph at the right. Each patient can be given the type of exercise he needs.

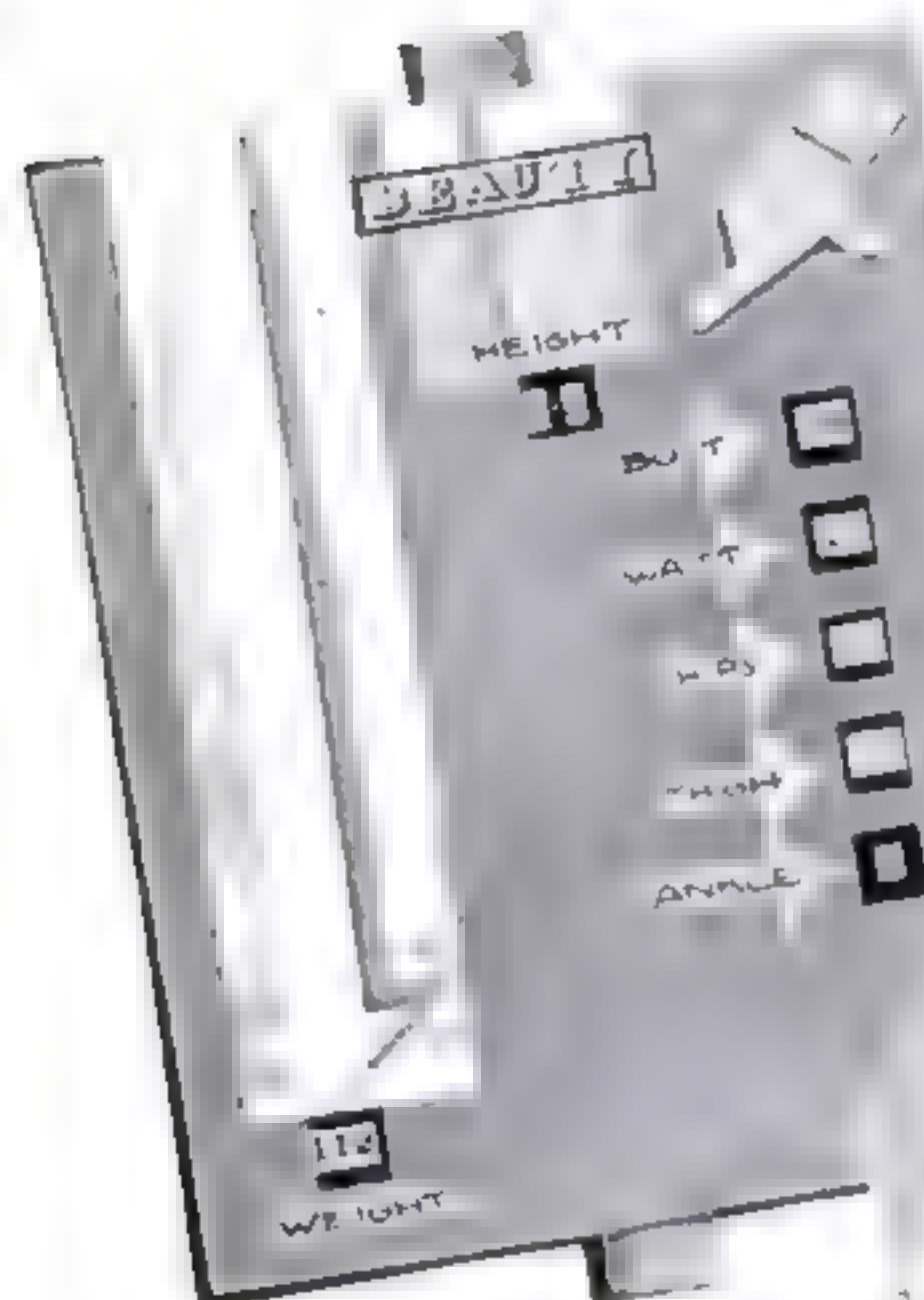
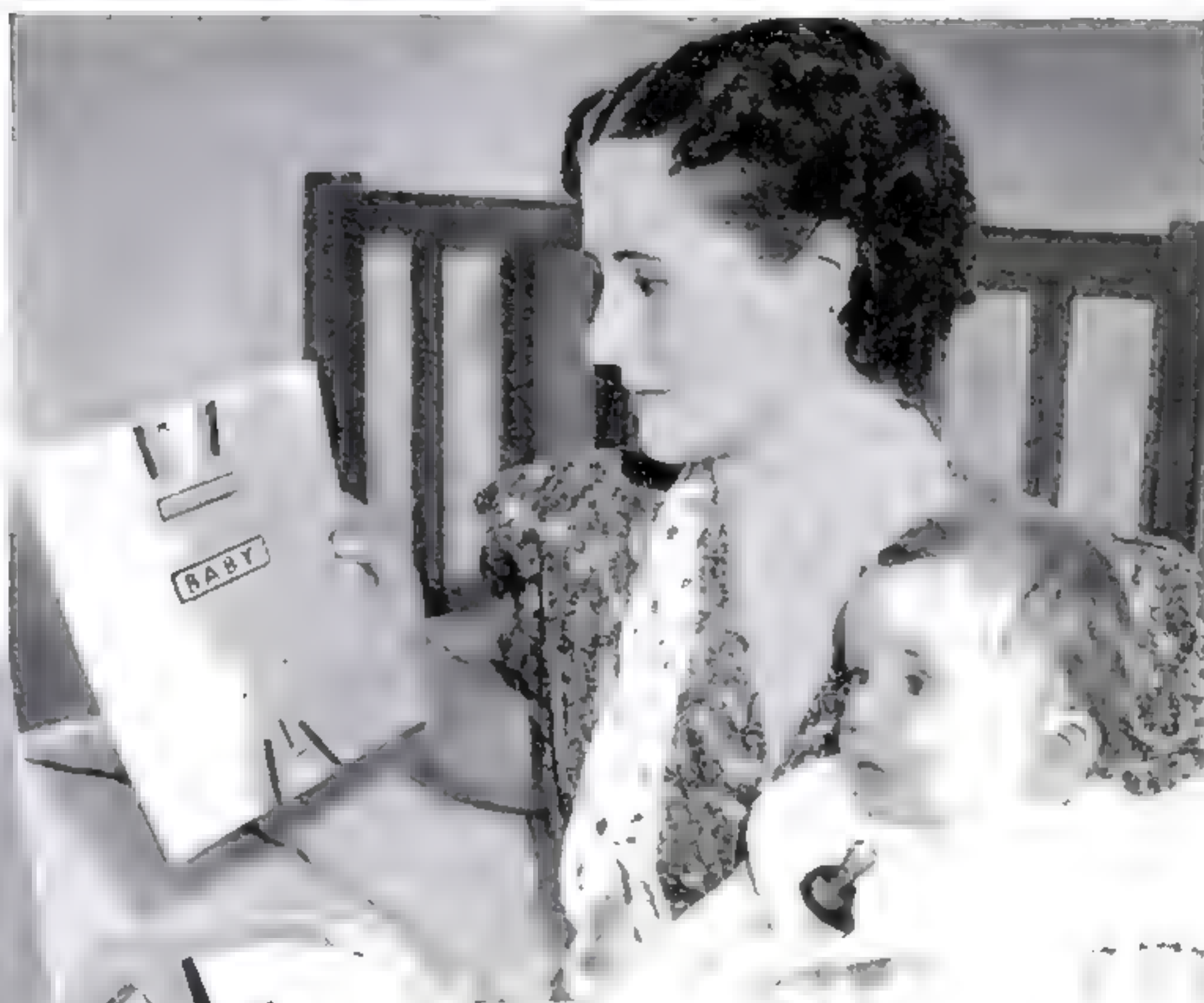


Child patients at a New York City hospital on their merry-go-round

Charts Put Facts at Your Finger Tips

What to do for the baby, and when, is learned by turning the disk of the chart pictured at right

When the beauty chart below is set for a woman's height and weight, slots in the panel indicate the ideal body measurements

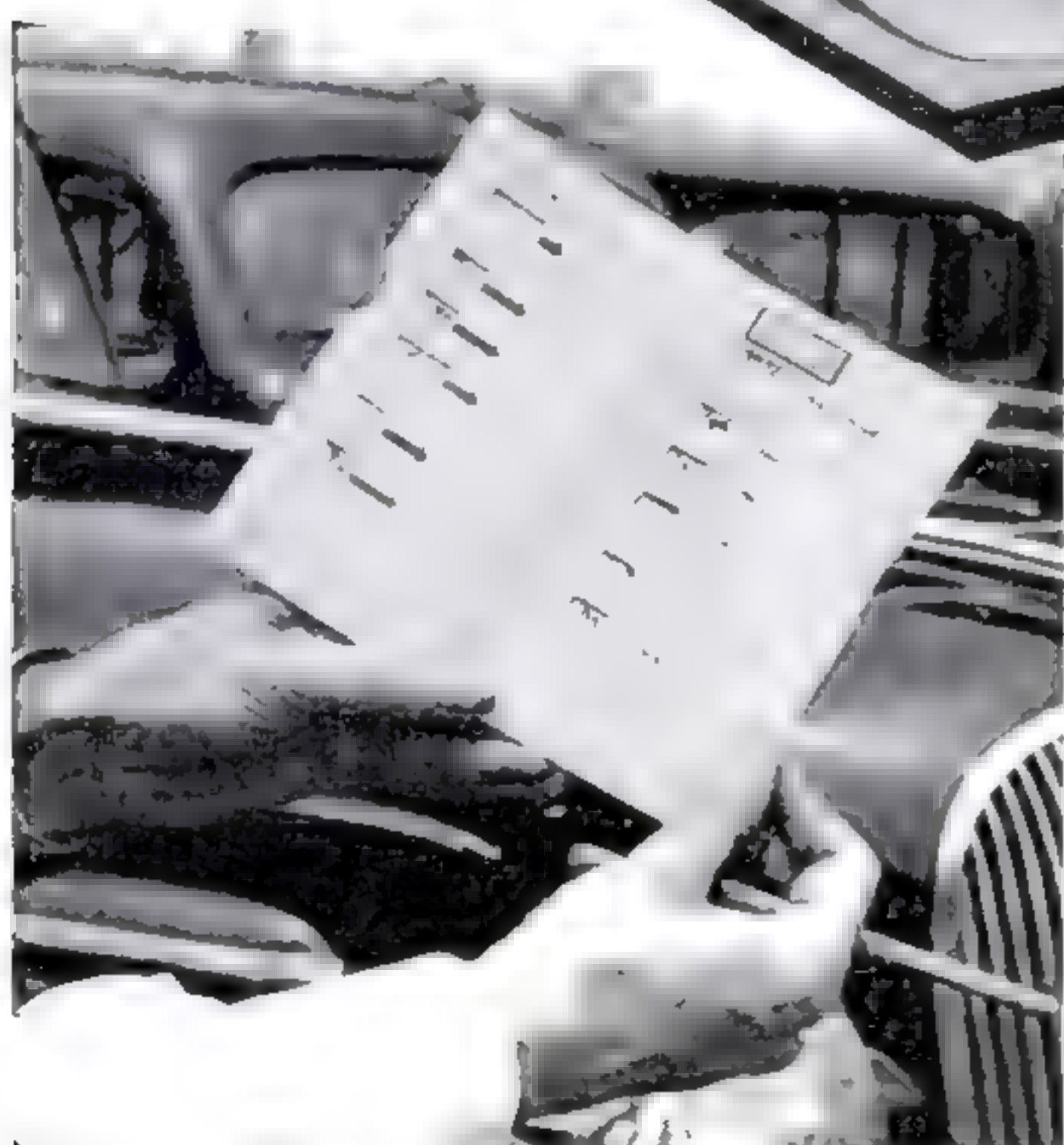


You can ask the device at right whether your shirt, tie, and suit "go" together



WHY not devise a system whereby facts and helpful advice on specific subjects could be concentrated in the form of revolving or sliding charts that could be carried in the pocket or conveniently hung on the wall of an office, workroom, kitchen, or nursery? That idea occurred not long ago to Harriet B. Meyer, of New York City, whose business is supplying information on a wide variety of subjects,

mainly to industries. The result is the charts pictured in the photographs on this page. One, planned for busy mothers, is a baby chart, with a central information disk which is turned to reveal through a top opening what to do about feeding, sleep, bathing, and other child-care duties, while a lower window indicates the best or most efficient time of day to do it. The pocket-size chart pictured at the lower left enables a motorist to keep a running account of his automobile expenses by means of a group of removable tabs and slots. In a home-decorating chart, a series of disks turning on a common axis are rotated by hand to demonstrate harmonious color combinations that will insure a pleasing blend of shades in curtains, rugs, upholstery fabrics, wall coverings, and furniture. Still another chart furnishes information on the ideal physical measurements for women of various weights and heights.



Records of car maintenance and expense are kept easily on the tabs of this folding pocket chart



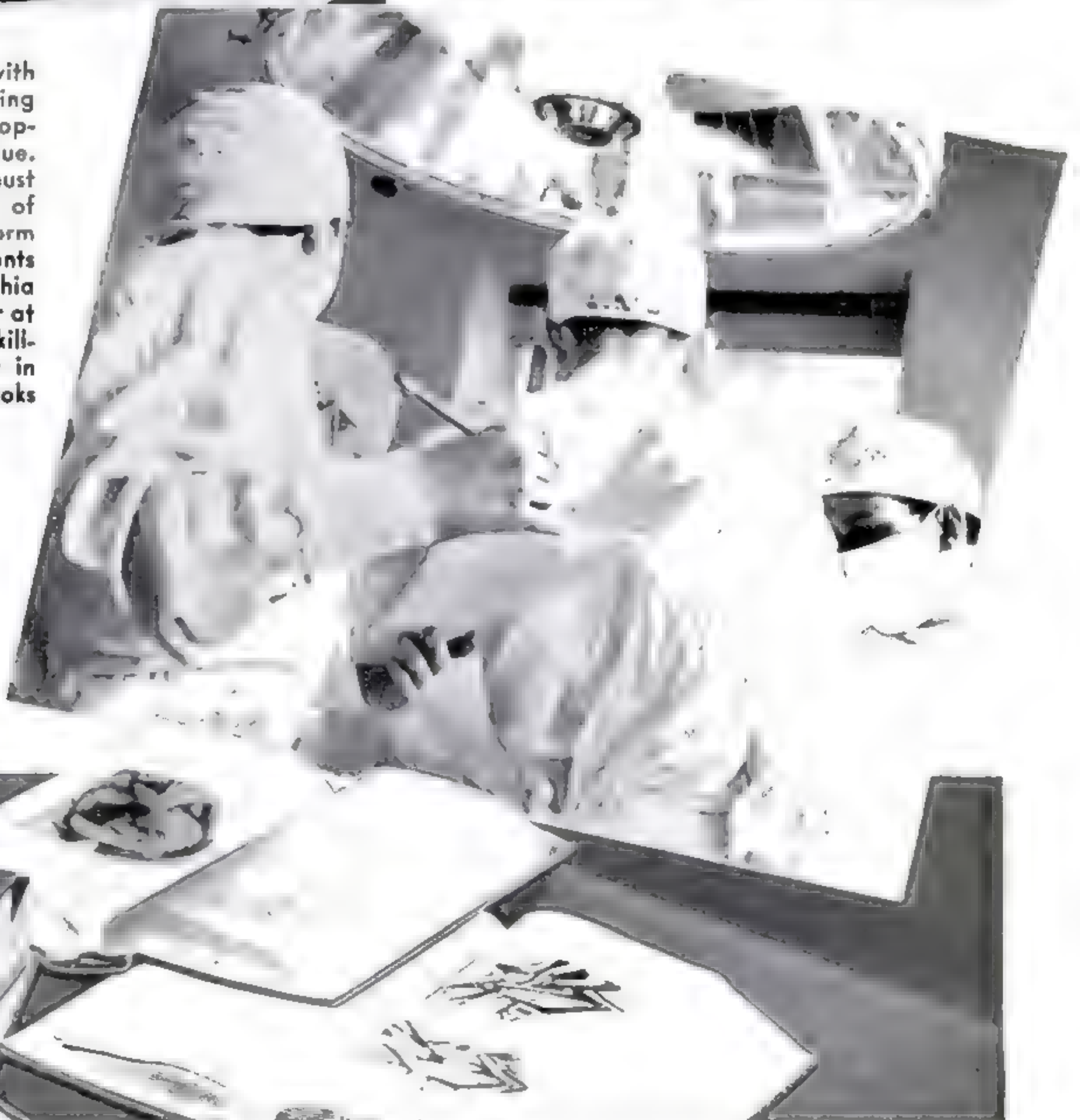
WILL THE CITY OF THE FUTURE LOOK LIKE THIS?

ELEVATED express highways passing through special "motorway" buildings are a feature of a plan proposed by engineers of the Automobile Club of Southern California for handling traffic problems in metropolitan areas. In the photograph above, showing a scale model of "Every City" designed to illustrate the plan, such a highway is seen entering a miniature building near the center of the model.

She Sketches Operations

SKETCHING the details of major surgical operations is the unusual job assigned to Gladys E. Lande, Philadelphia, Pa., medical artist. Donning a sterile costume, complete with white gown, hat, and face mask, she observes over surgeons' shoulders, making lightning sketches of the progress of the operation. Later, from the sketches made in the operating room, she prepares complete color drawings that illustrate in minute detail the surgical technique used, and the appearance of incisions and exposed tissues at various stages. Many of her drawings are reproduced in medical journals and books, while others are enlarged into huge charts for the instruction of students and nurses.

Gladys E. Lande with some of her amazing sketches of surgical operations and technique. To draw them, she must peer over shoulders of doctors as they perform operations on patients in several Philadelphia hospitals. You see her at work at right. Her skillful drawings appear in numerous medical books



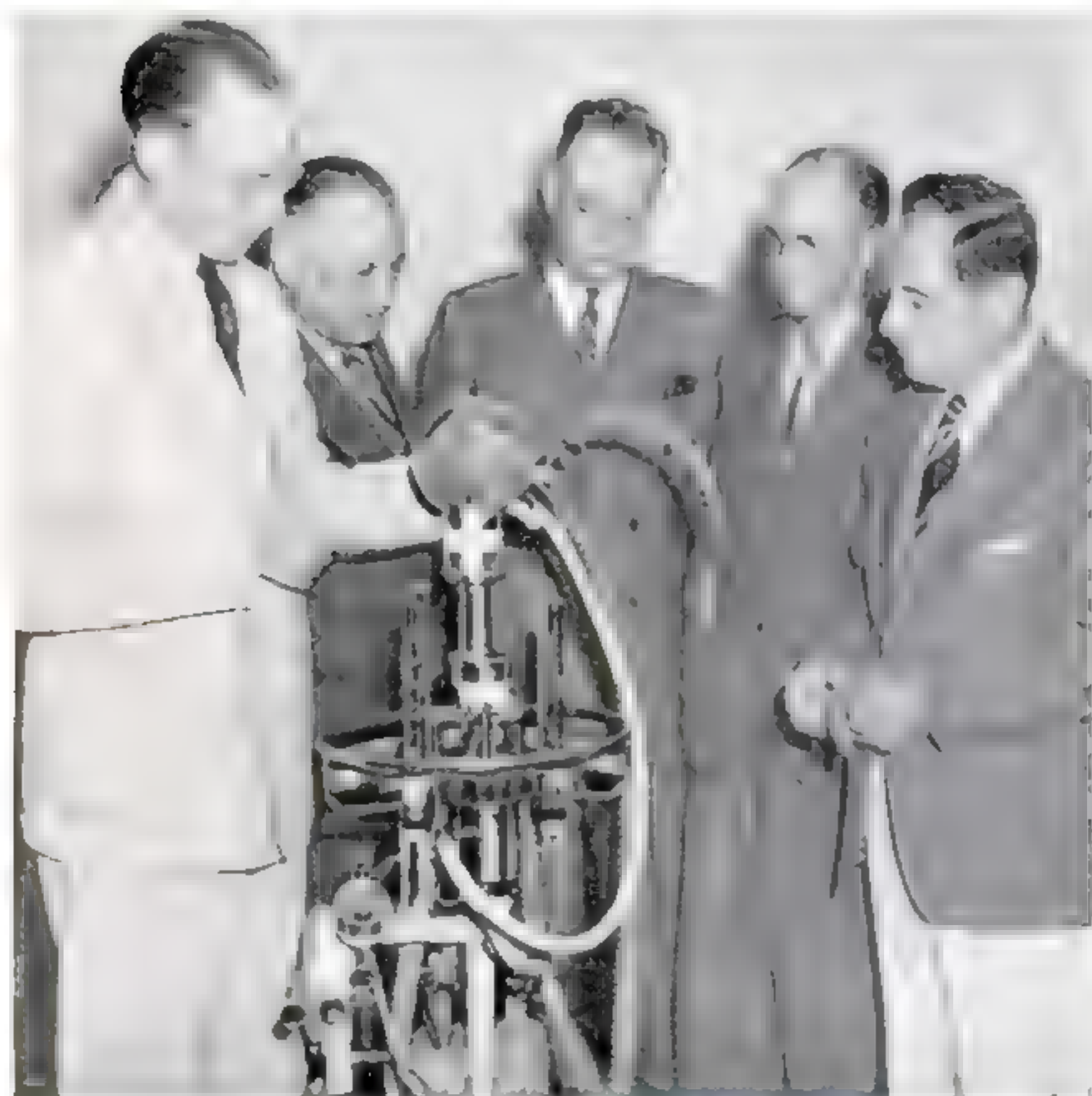
Kit Has Paints for Black-Light Tests

One of the odd effects obtainable with the new kit. Shown below, the outfit includes fluorescent paints and a lamp



PAINTS that glow in the dark under the unseen rays of ultra-violet light are now available to amateur experimenters in kit form. One outfit consists of a two-watt ultra-violet lamp and reflector, operating on

110 volts A.C. or D.C., and six bottles of fluorescent paint that is colorless under ordinary light. When stage sets, costumes, advertising signs, or other objects are painted with the liquids, they can be made to shine with vivid colors in darkness, by focusing on them the invisible rays from the ultra-violet lamp. Phosphorescent paints, which glow in the dark after they have been exposed to ordinary light, are also obtainable.



Dr. Clarence Crafoord explaining his artificial-breathing machine

Pinch-Hits for Lung During Operations

A BREATHING machine, which not only inhales and exhales for a patient, but also keeps his lungs under an anesthetic, was recently demonstrated to a group of American surgeons in Los Angeles, Calif., by its inventor, Dr. Clarence Crafoord, of Sweden. While one lung is deflated to permit a surgical operation to be performed on it, the apparatus supplies a mixture of air and oxygen to the other lung, thus forcing the lung to breathe without the normal movement of the muscles of the chest and diaphragm which might interfere with the surgical work. At the same time the novel machine introduces a local anesthetic to the entire region undergoing the surgery.

Shoot the Works!

By BERTON BRALEY

Oh, "safe and sane" is a sound refrain,
And thrift is a gift that's splendid;
And prudence pays in a hundred ways,
And caution is recommended.
But now and then in the hearts of men
There's need for more reckless phrases
When the die is cast and the pulse beats fast
And discretion can go to blazes!

There are times to make any coin you stake
A matter of calm decision.
There are times to back with your total stack
Your wackiest hunch or vision.
There are times to look ere you leap a brook,
And times, when the floods are brimming,
To plunge and ride on the swirling tide
And trust to your skill in swimming.

Yes, it's well to wait and to calculate
And figure on circumstances,
But at times your verve and your nerve must
serve
In a game where you risk your chances;
When prudence irks and you shoot the works
With never a qualm to bind you,
Your path made bright by the flaming light
Of the bridges you've burned behind you!

Portable Fire Escape Hooks on Window Sill



This all-metal ladder makes any window an exit

DRIPPED from any window, after its upper end has been anchored to the sill, a portable all-metal fire escape of new design may prove a life-saver in an emergency. Stirrup-shaped rungs, supported by chains, provide sure footing for safety. Made in two lengths, for two and three-story buildings, the device is declared strong enough to support 1,800 pounds.



Telescope Built for Two Lets Children See Stars

TO ENABLE his children to share his interest in astronomy, J. Lawrence, of Astoria, N. Y., has devised the ingenious twin telescope holder shown above. When he points his own spyglass at a star, the young observer at the other eye-piece is sure to see the same star, since the frame holds the telescopes rigidly parallel. Slots in the mounting provide a convenient hand hold as an aid to users.

Tool Cuts Balsa Strips

ACCURATELY cutting a sheet of lightweight balsa wood into strips of any desired width, a new tool saves time for model-airplane builders. The knife blade is replaceable.



Cutting balsa wood into strips for model-plane making

Water-Cooled Lamps Used in Television



PROVIDING television studios with the brilliant lighting they require, without subjecting actors to unbearable heat, was the problem research engineers recently solved by designing light units employing new water-cooled, cigarette-size, mercury arc lamps (P.S.M., Apr. '38, p. 44). Circulating water passes through hoses connected to each unit to absorb heat.

Sally Eilers, movie star, examining one of the powerful television lighting units. At upper left, it is seen in its studio setting

Students Build Scale Model of Niagara Falls

GEOLOGY students at the University of Buffalo, N.Y., after three years of concentrated effort, recently finished the remarkable scale model of the falls and gorge of the Niagara River shown at the right. The largest and most accurate map of the area ever executed, the model weighs more than a quarter of a ton, measures eleven feet long and six feet wide, and contains about 12,000 pieces of plywood, which, with papier-mâché, was the material.

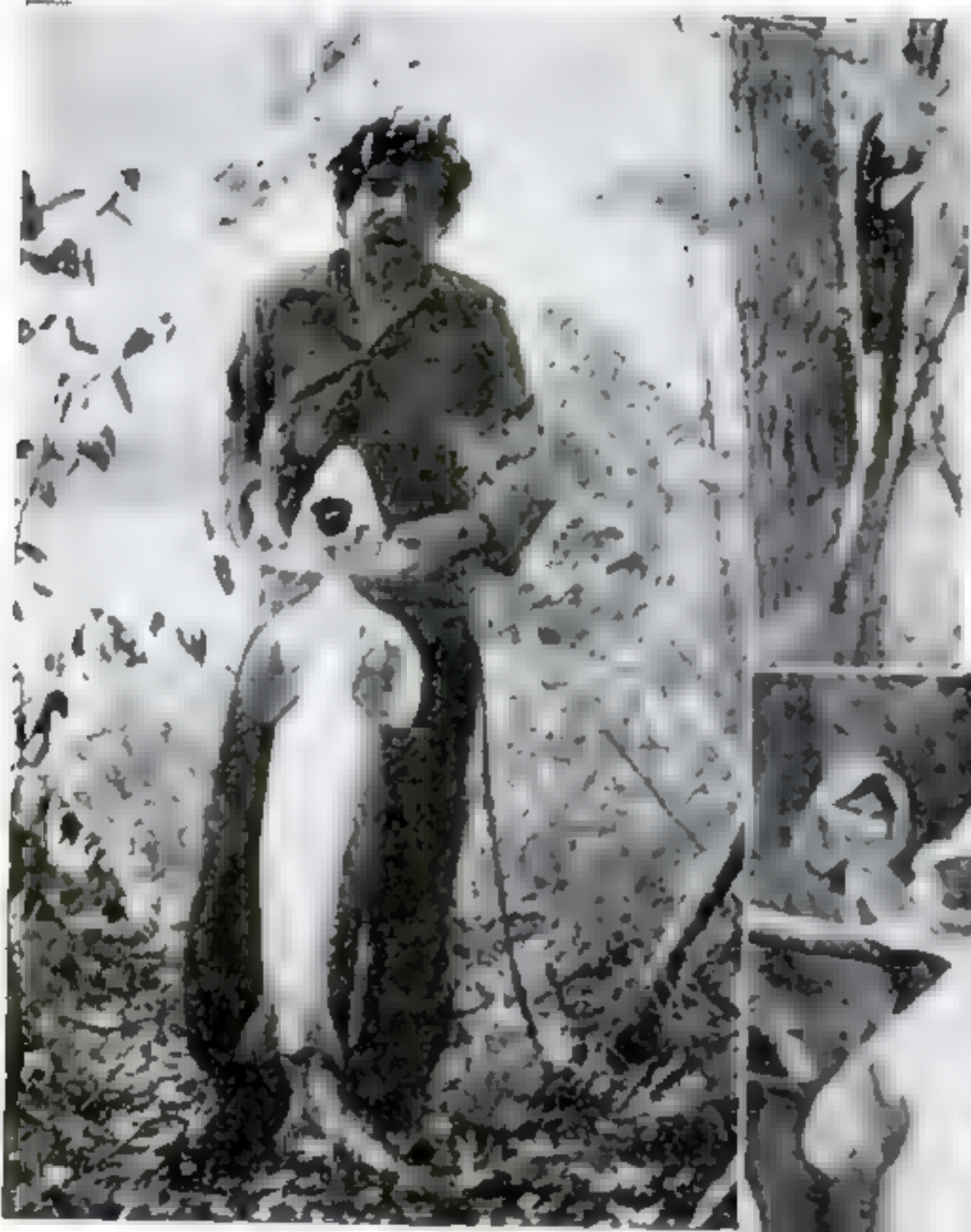


It took three years to make this model of the Niagara Falls area

Flying Fish Wagon

AIRPLANE BRINGS CAVIAR
FROM THE CANADIAN WILDS

CAVIAR from the Canadian wilderness is now being sold in American cities as the result of a unique fish-plane service inaugurated by Capt. Roy Maxwell, World War aviator and former director of the Ontario Forestry Air Patrol. Using a swift Bellanca seaplane, Maxwell lands on isolated lakes and streams to collect sturgeon and the roe, or eggs, from which caviar is made. Cree and Objibway Indians have been supplied with nets and night-lines and trained in catching the valuable



Taken from a lake in northwestern Ontario, this sturgeon will be in New York in less than forty-eight hours



Gathered at central points, the sturgeon are kept alive on the lake shores until the plane arrives. Killed and cleaned, they are then packed in ice

Maxwell's "flying fish wagon." Often more than 150 miles from a railhead, it keeps a rendezvous with Indian fishermen on the wilderness lakes. It is shown here waiting to receive its cargo

fish considered a delicacy in the U. S.

About a year ago, Maxwell obtained a government concession to establish a sturgeon fishery in the wild Albany River region of Ontario, north of Lake Superior. With Nakina, a point on the Canadian National Railway, as his central camp, he laid out five radiating lines, like the spokes of a wheel. Along these he flies to the main sources of sturgeon among the lakes of the Albany River region. Nearly 10,000 square miles of unbroken wilderness make up the area over which Maxwell's "flying fish wagon" comes and goes.

The sturgeon caught by the Indians are moored alive near shore, cords being fastened to their tails from trees and bushes. When the fish plane is sighted, the sturgeon are quickly hauled in, killed, and cleaned. As much as 650 pounds of fish and roe are flown out from a single lake on a single trip. The farthest lake visited is 150 miles from Nakina.

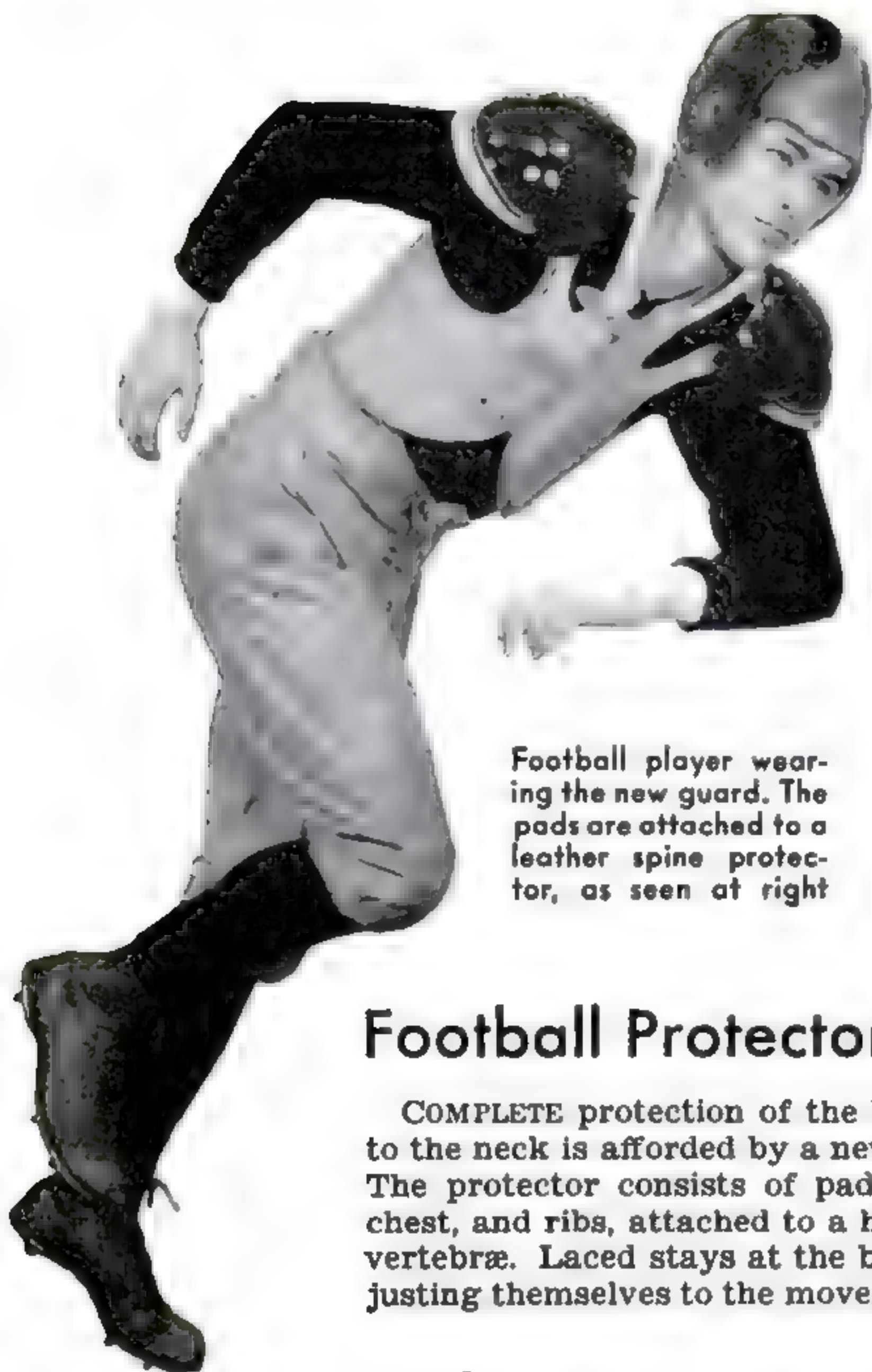
During the flight to the central base, a special demountable canvas ice box keeps the load fresh. Once inside, it is assembled and filled with ice. At Nakina, the cargo is re-iced and loaded on a fast train. Forty-eight hours after it is caught the sturgeon is in New York ready for sale.



Loading sturgeon and its egg roe for caviar on Maxwell's plane



Native fishermen clean and weigh their catch for packing in a special canvas ice box the plane carries



Football player wearing the new guard. The pads are attached to a leather spine protector, as seen at right



Football Protector Guards Player's Spine

COMPLETE protection of the body of a football player from the waist to the neck is afforded by a new combination guard recently introduced. The protector consists of pads that cushion shocks on the shoulders, chest, and ribs, attached to a heavy leather piece that shields the spinal vertebrae. Laced stays at the back of the protector are elastic, thus adjusting themselves to the movements of the player's body during a game.

Small Electric Device Cuts Stencils

STENCIL signs and cut-out letters, designs, and figures are easily and quickly made with a small-size cutting device now on the market. Electrically operated, the machine cuts figures from any light material in sizes from three eighths of an inch up to three feet in height. It operates in any direction and by tracing, drawing, or pasting a design on the material, it is easy to follow and cut out the outline. A built-in floodlight illuminates the work. With each outfit, the manufacturer furnishes a straight-line guide, a perfect-circle guide, and a supply of spare cutting needles. Suggested uses include making cut-outs for show cards and cutting motor gaskets from sheet cork.



Compact electric stencil cutter. It easily follows designs drawn, traced, or posted on a material

Handbag Holds No Secrets

A TRANSPARENT handbag for women is now becoming a fashionable accessory abroad. Made of a clear, semistiff, transparent plastic material, with decorative stitching at the edges, the bag reveals its contents at all times. The owner can even powder her nose while looking in a mirror that is inside her handbag, as shown in the photograph at the right.

Noses and Ears Replaced with Spares of Rubber

RUBBER noses and ears, to replace natural ones lost by accident or disease, are now being supplied to patients at the Mayo Clinic, Rochester, Minn. Made of latex, the spare parts may be worn until a new nose or ear can be provided by plastic surgery—or, if the patient desires, they may be used permanently. They usually are attached by means of a liquid adhesive, though the false noses can be held in place by spectacle frames.



She's using a mirror in her transparent bag

Electric Combine Cultivates Hotbeds

STRIDING along over rows of hotbed frames on a giant Russian farm, the novel electric combine pictured below performs all the operations required for the cultivation of hotbed crops. Operated by one man,

the machine opens the frames, scatters soil, levels the beds, marks out rows, sows seed, waters, weeds, fertilizes, sprays, and polinates plants. When it finishes one bed, it closes the frame and moves on to the next.

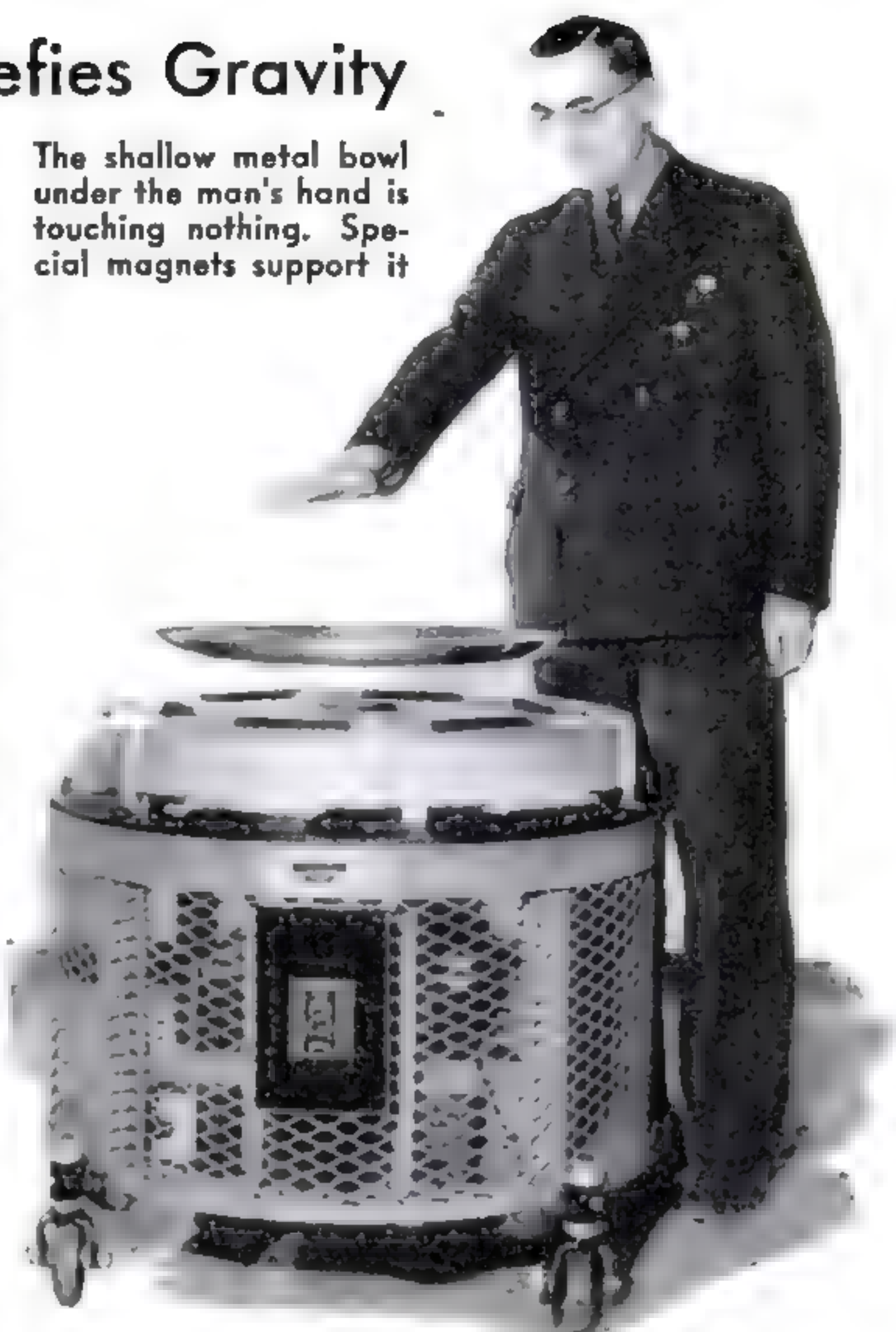


Hotbed cultivator at work. It opens the frames, puts the bed in order, and moves on to the next one

Bowl "Floating" in Air Defies Gravity

DEFYING the force of gravity, an aluminum bowl that is part of a novel device known as an "electromagnetic levitator" fascinates crowds at the New York World's Fair by floating in air with no visible means of support. Developed by General Electric research engineers as a demonstration of electric and magnetic forces, the bowl is invisibly supported by the force arising from the interaction of electric currents induced in it and a magnetic field created by coils and an iron core in a housing underneath. A second magnetic field sets up an unseen fence around the metal bowl to keep it from slipping sideways. The force that creates this curious effect is of the same type that makes an electric motor whirl, and the mechanism employed to produce the force is similar to that used to produce current in an electric generator. No practical use has yet been found for the floating-bowl apparatus, although Fair visitors have advanced a number of suggestions. Because the bowl becomes hot while floating in mid-air, several persons have proposed that it be used in restaurant windows as a spectacular means of cooking pancakes. Another visitor thought it might be used to prevent air bombs from falling on battleship decks.

The shallow metal bowl under the man's hand is touching nothing. Special magnets support it



Mobile Burner Clears Tracks of Weeds

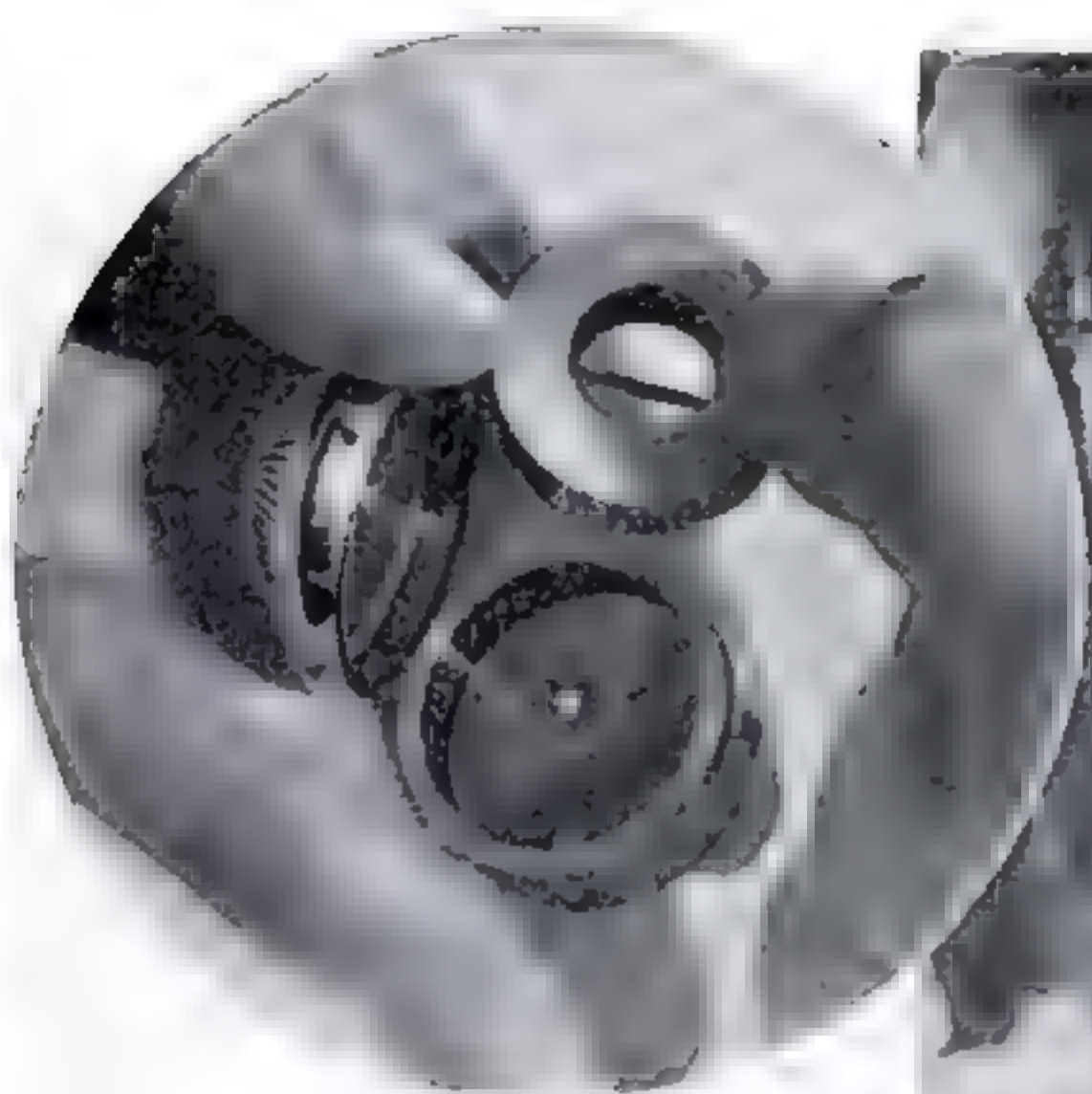
WEEDS, high grasses, and other vegetation along railroad right of ways are now being cleared with a new swinging-boom fire machine. Operators of the new machine, which

rolls over the railroad tracks, man controls that swing a fire-breathing boom fifteen feet or more to the side of the track, as shown in the photograph below.



Flames spouting from the end of the swinging boom set fire to and destroy weeds along the railroad tracks

Lab "Separator" Is Built at Low Cost



BUILT for as little as \$150, a low-cost ultracentrifuge developed by Dr. James W. McBain, of Stanford University, Palo Alto, Calif., makes it possible for any research laboratory to own this useful apparatus for separating materials. Extremely small in size, the device operates on the same principle as the cream separators used in dairies, whirling substances in containers at high speed until their heavier components break away from their lighter ones. In the past, construction of an ultracentrifuge has called for an investment as high as \$50,000, far beyond the reach of most laboratories.



Dr. James W. McBain with parts of his new low-cost ultracentrifuge. In circle is the ring in which test substances are whirled rapidly

The new, small-size ultracentrifuge spins around 3,000 times a second, subjecting test substances to a force 250,000 to 300,000 times as great as gravity.

Mounting Holds Sport Telescope on a Car Window

WITHOUT leaving their cars, naturalists, sports spectators, and automobile tourists can obtain a magnified view of distant scenes and objects when they use a telescope mounted in a recently introduced support that fits snugly over the top edge of a lowered car window, as shown in the photograph at the right. Once the telescope is in place in its mounting, it moves up and down with the car's window.



Clamped to the car window, the mounting provides a handy telescope rest

Outguessing Forest Fires

HOW RANGERS GET THE JUMP ON THE RED DEMON



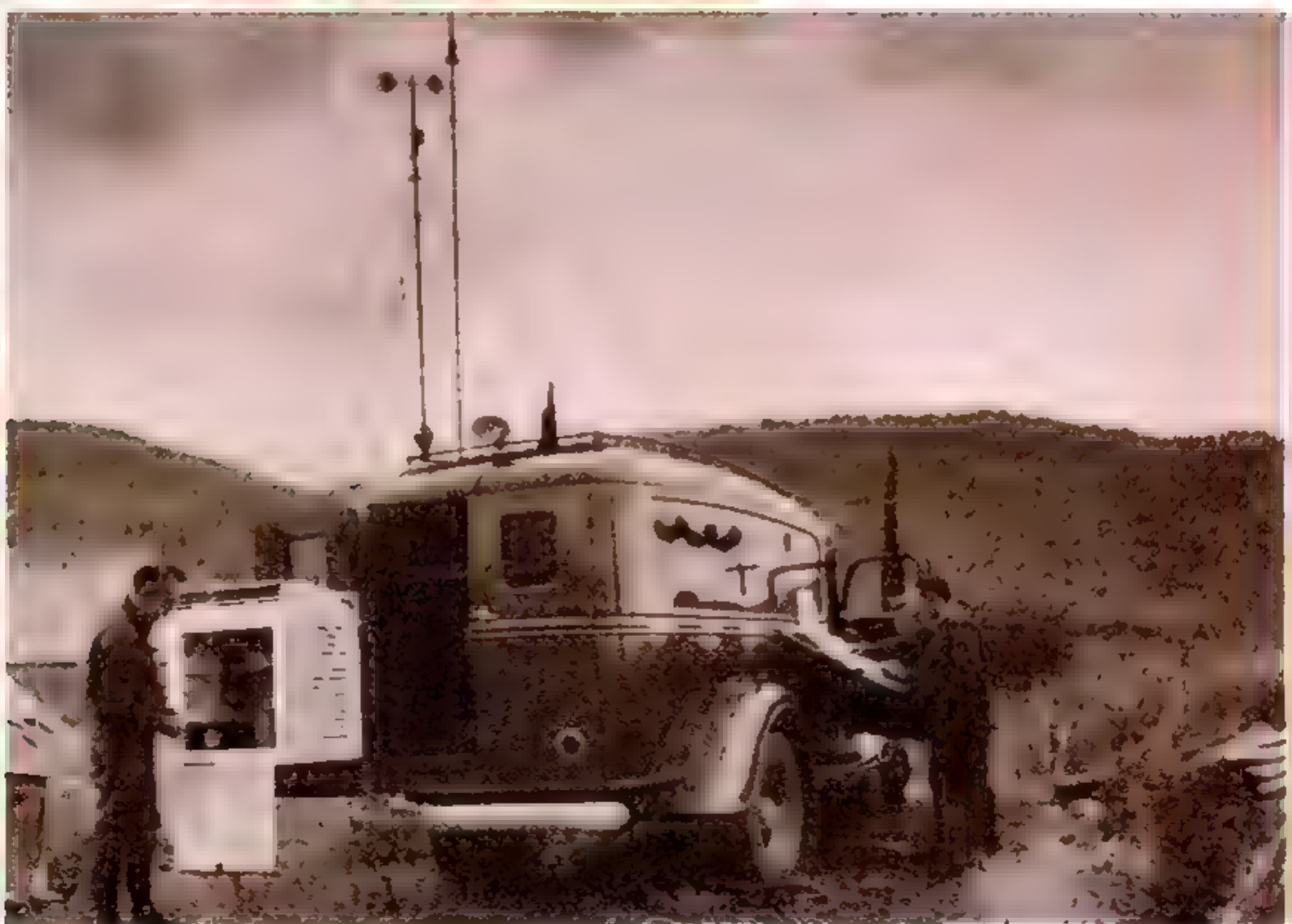
Forest lookout on Red Mountain, Wash., studying his recording anemometer to learn the velocity of the wind. Below, a mobile weather station for fire forecasting

LIGHTNING slashes from the sky into a heavy stand of Douglas fir, threatening to wipe out in a scorching conflagration nature's work of two centuries.

Can forest rangers anticipate the blaze and beat it to the punch by mobilizing men and tools at strategic points? How far away can rangers see smoke from even the smallest blaze? How fast will the flames race through the forest? Where and when are forest fires likely to start?

For a decade, U. S. Forest Service experts have been seeking means for outguessing flames in the woods. Fires, they know, are started largely by careless visitors and by lightning. Recently they have perfected ingenious means of forecasting fires, and arriving at the scene often before flames lick at the bracken and race through branches.

Delicate instruments developed and tested in five large outdoor laboratories of the Pacific





Flames licking a Douglas fir snag. The ranger below is taking a reading from a portable wind gauge tied to a willow in the wake of a big conflagration



Northwest Forest Experiment Station—wind gauges and vanes set up on sticks alongside roaring infernos, hygrometers for measuring moisture in the air, weighed sticks revealing how much water saturates forest growth, thermometers, and haze meters—provide individual bits of information. Assembled on a novel recording board, the data present an accurate picture of fire danger, which automatically predicts blazes with amazing accuracy.

In preparing the fire-forecasting system, forest researchers early attacked the visibility problem. They placed smoke pots around the forest. Rangers spotted the small telltale clouds six and eight miles away. They developed a haze meter which measures the clearness of the air. They determined that smoke from a fire ten by twenty feet square in fir or

pine is visible to lookouts with good eyesight seventeen miles in clearest weather. By using the ingenious meter, a lookout calculates quickly the "visibility distance" and knows instantly the area within which he can spot a beginning fire.

Add low visibility to dry wood and weeds—and lightning—and you have the makings of an inferno.

Ross Shepard, ranger in the Elk Creek District of the Columbia National Forest, Wash., looked out one recent morning over the wind-swept woods spreading below his lonely station. Three times that day he

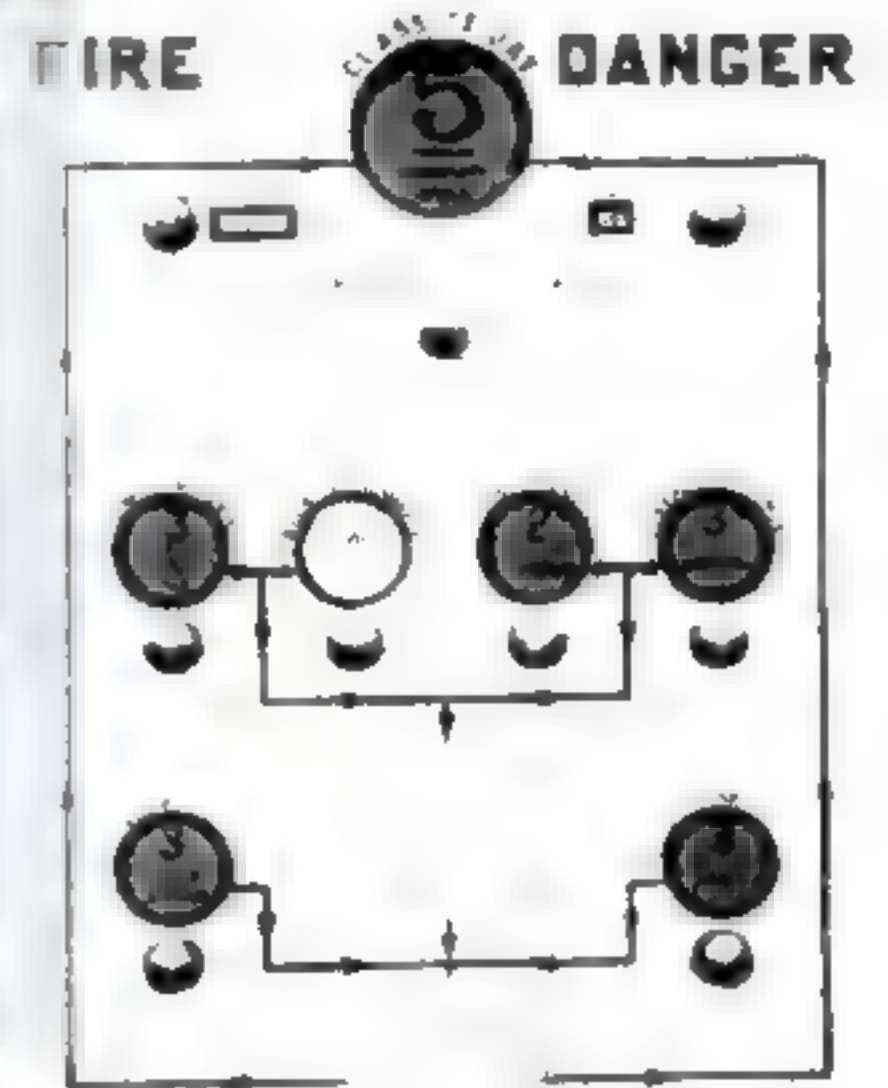
weighed his sticks, found the moisture content very low. He turned a fan on the hygrometer and noted the humidity. Wind was blowing twelve miles an hour. Pointing his haze meter, he could see less than a mile. Together, his findings

By
**ANDREW R.
BOONE**



A ranger reading fire-danger instruments at the Pringle Falls Experimental Station in Oregon. Wind and humidity are chief factors

On the "fire-danger" board below, five sets of observations are recorded as a basis for estimating the risk of fire on any given day



TESTING THE LOOKOUTS. Smoke released in heavy timber checks the alertness and range of vision of the lookouts. At the right is a fan-blown hygrometer which measures relative humidity. Low humidity increases risk

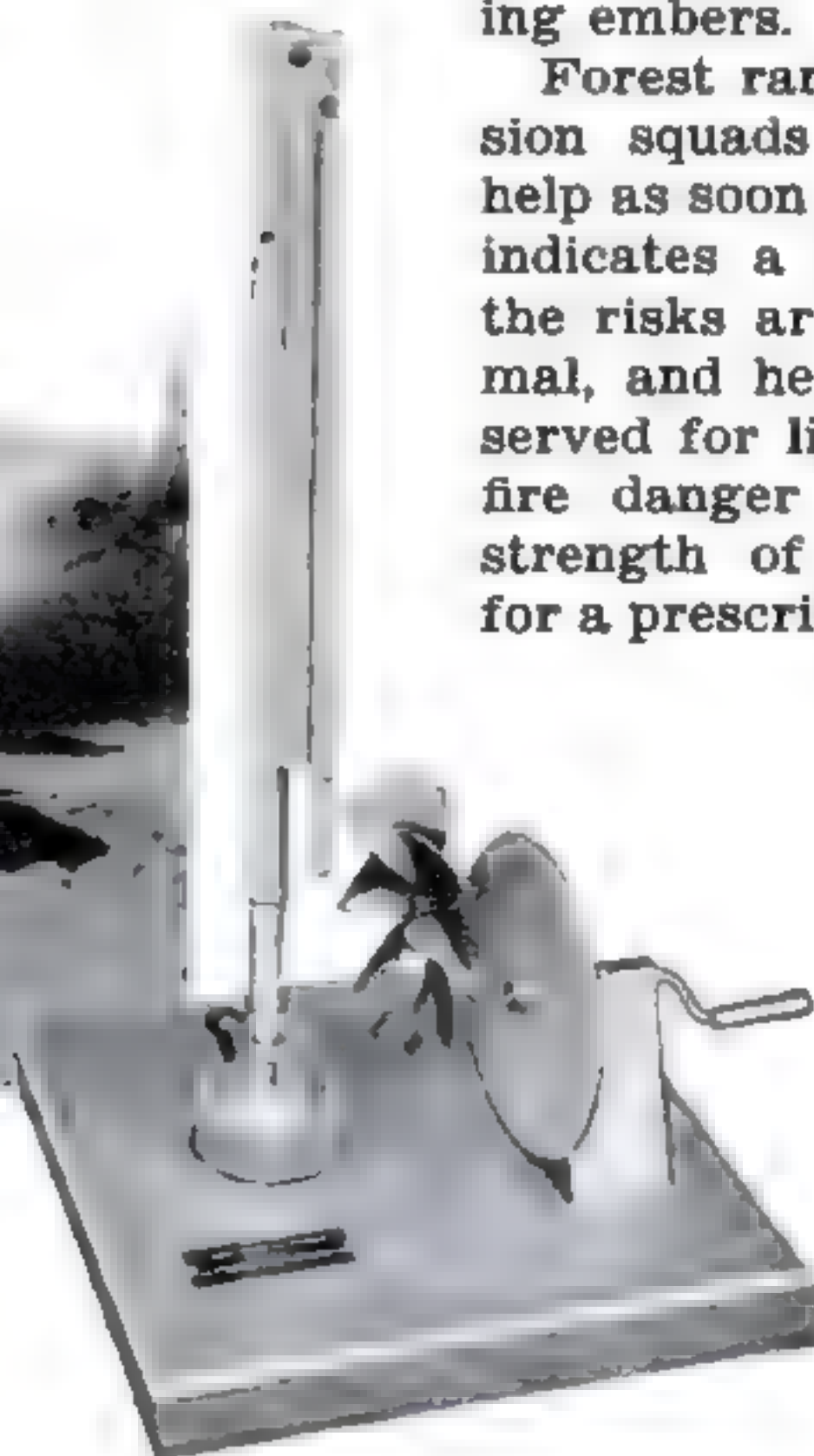
indicated a "class 7" day, or a "class 4" risk—the worst possible.

By nine o'clock, visibility had dropped to zero and lightning was cracking over the forest. Shepard waited no longer. "Looks very bad," he reported by telephone to the district supervisor, whose only reply was, "hit 'em early, and get 'em small."

Shepard called for fifty fire fighters and a cook, assembled the force at headquarters. When the haze cleared, eleven fires appeared almost simultaneously, all the result of lightning flashes, and in a short time the fire crew reduced them to smoldering embers.

Forest rangers move out suppression squads and begin calling for help as soon as the fire-danger board indicates a heavy risk. Ordinarily the risks are classified as low, normal, and heavy, with "4" being reserved for lightning. Each class of fire danger calls for a particular strength of suppression force and for a prescribed plan of action.

Not only can fires be outguessed, but recently factory-production methods have been applied to their suppression. Around the fringes of each large blaze you will find young rangers observing portable anemometers, tied to saplings stuck in the earth or steel bars





To supply isolated fire-fighting parties, rangers drop food and tools from planes with crude parachutes. Right, using a field radio set dropped from the sky

driven into fallen logs, checking velocities and directions of winds and drafts caused by the heat; noting visibility to near-by and distant points; taking samples of wood and undergrowth for moisture determination.

When flames get a head start, the fire fighters plunge into a forest to build wide, flame-halting trails. Here you would see an advance line locator outlining the route; a marker blazing the trail; squads of axmen, hoemen and shovelmen following, each striking a single blow as he marches past the flames. "Single-lick" trail building, this is



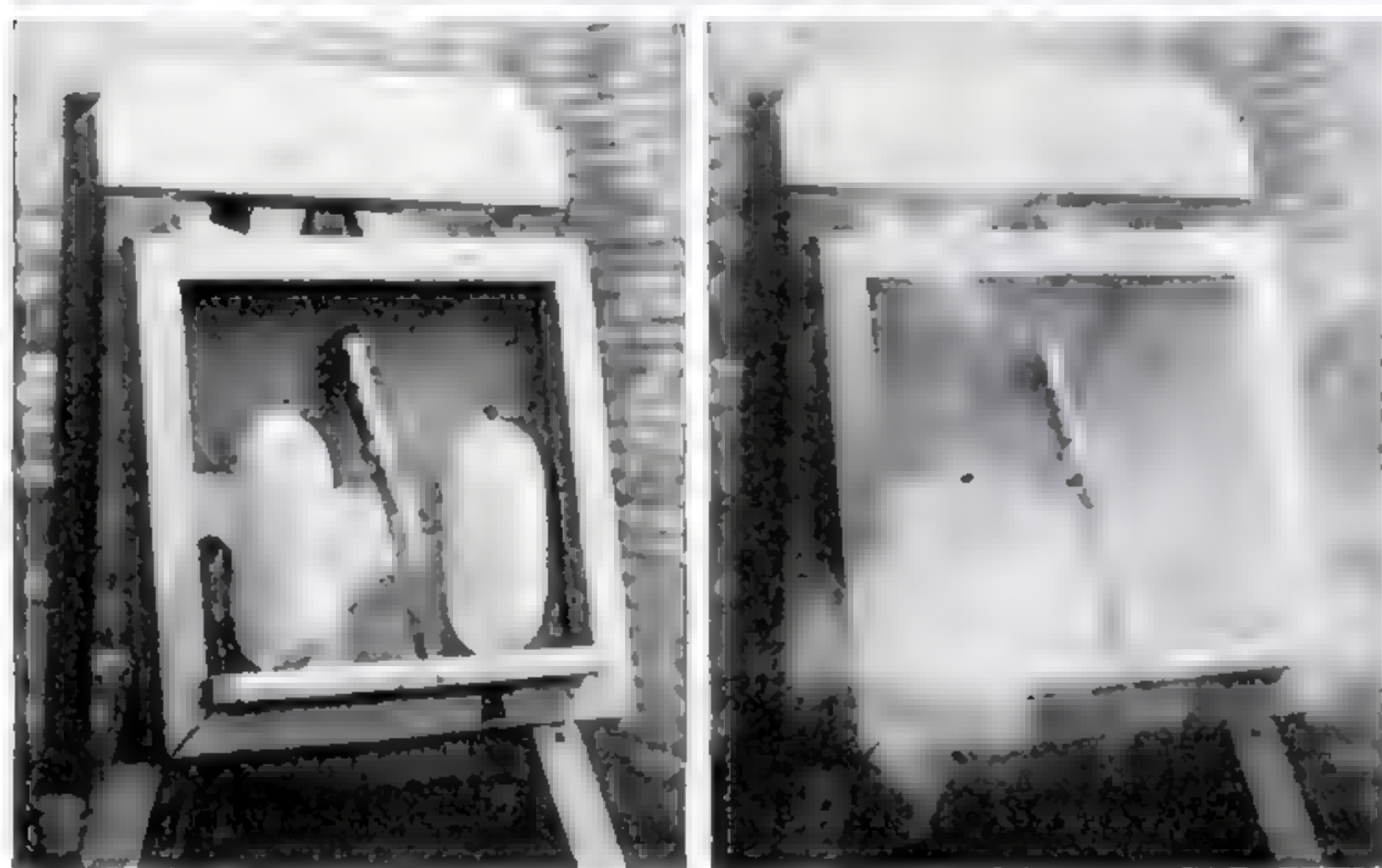
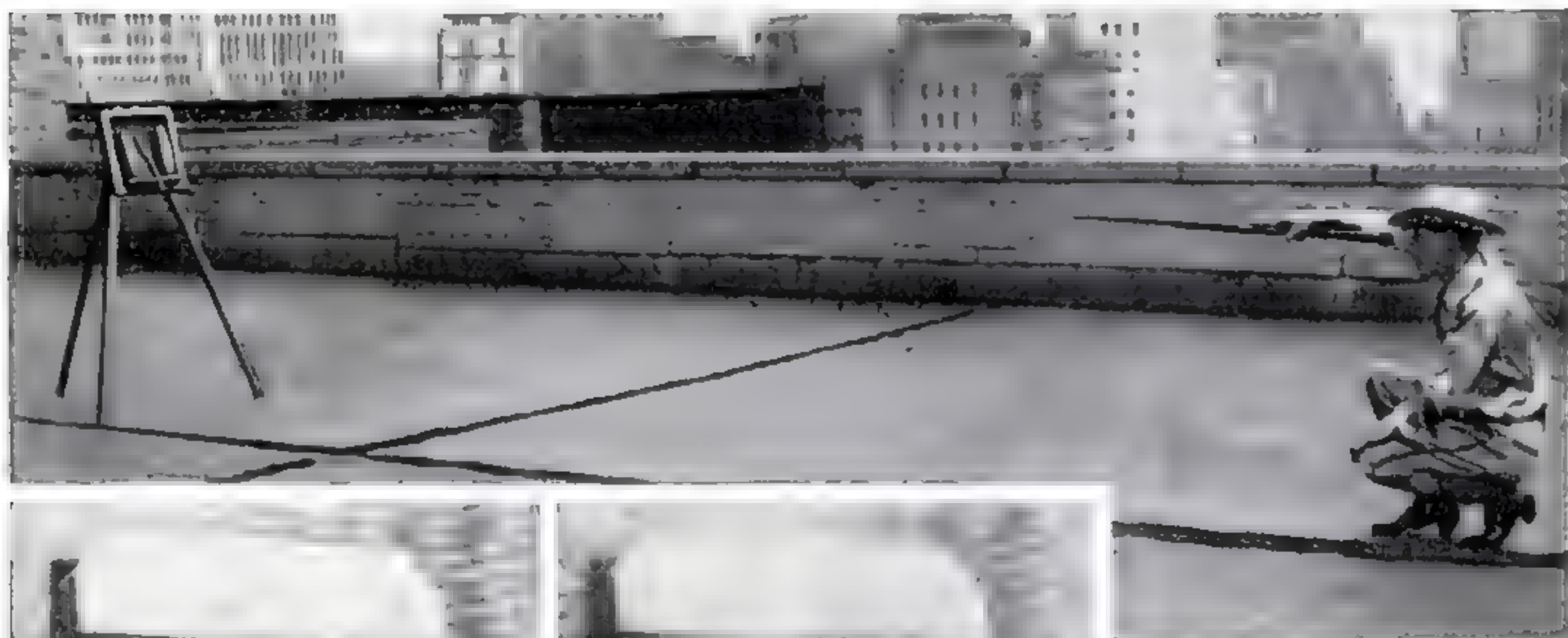
called, a method patterned after the assembly line of large factories, where each worker performs a single operation. On going fires, 100 men build three times more trail, cutting two-foot swaths down to earth, than by the old method.

At the height of a great fire, weary trail makers may find themselves fifty miles from the nearest highway. In such cases, planes drop supplies and tools to the hardy fire fighters by parachutes.



A Forest Service worker gathering samples of wood to determine the moisture content under varying humidity and temperature

Sharpshooter Splits Bullet on Knife



Tex Corey taking aim for his amazing marksmanship stunt. A knife blade splits the bullet, which bursts the two balloons

BY MAKING one bullet do the work of two, Tex Corey, expert marksman, of Clearwater, Tex., has carried the title of "Economical Sharpshooter." As his target Tex sets up a tripod on which he hangs a steel backstop having a small shelf at the bottom. On the backstop he stands a knife up-

Backing off from the target, Corey raises his .22 caliber rifle, holds it with one arm, aims at the knife edge, and fires. The bullet strikes the blade and splits in two, one half exploding the balloon to the right, and the other half smashing the balloon at the left, as seen in the photograph.

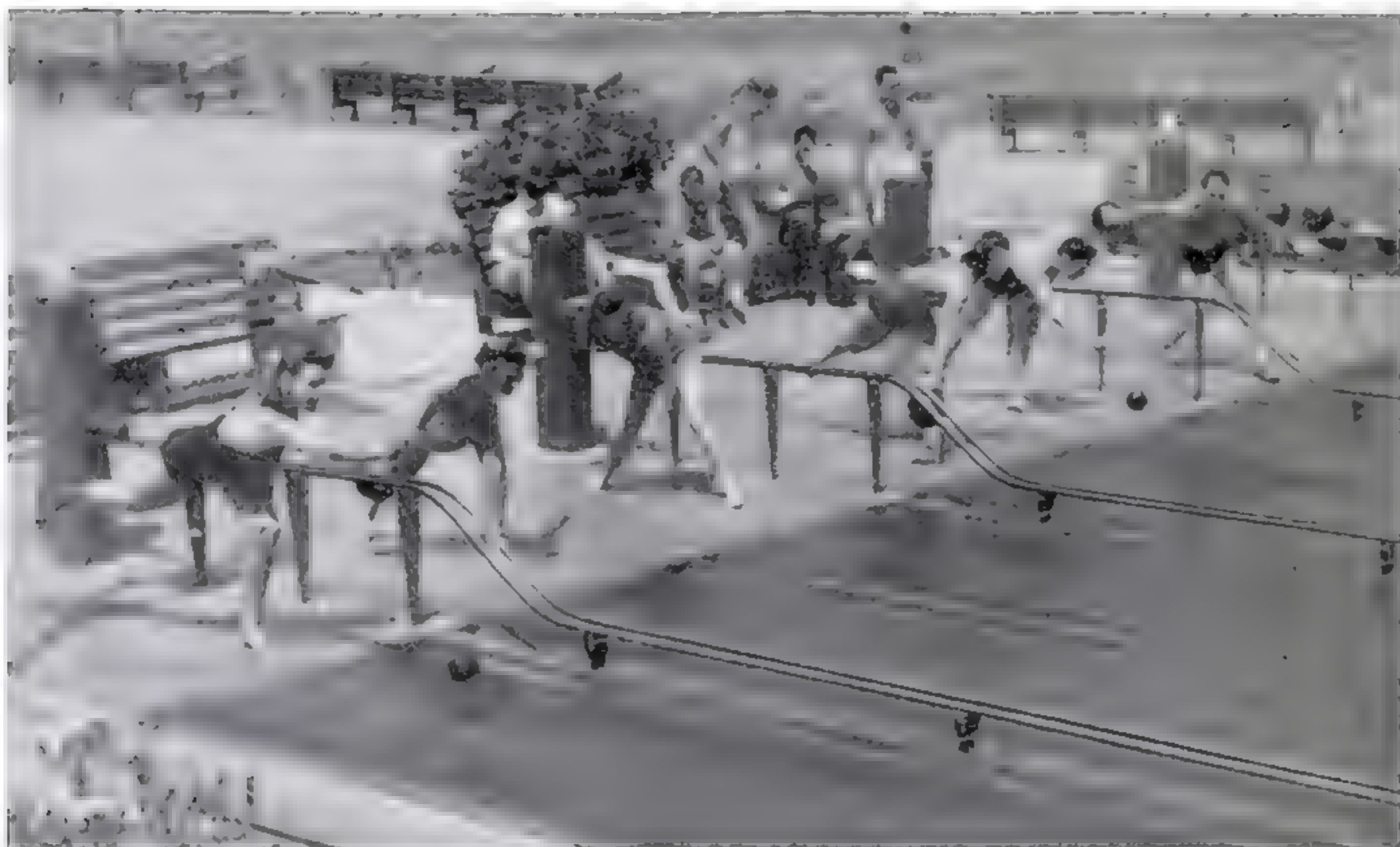
right, its sharp steel edge facing outward. On either side of the blade he places an inflated balloon sprinkled with white powder to help observers believe their own eyes when the shot is made.

Car Pillow Holds Toilet Kit



For a long auto trip, or on a picnic, this pillow doubles as a case for toilet accessories

TO ADD to the comforts of traveling on long motor trips, a new pillow recently introduced for car use acts not only as a cushion but also as a handy toilet case. Opening a slide fastener that extends around the side of the novel pillow reveals an interior compartment fitted with a comb and hairbrush, manicuring tools, soap, a full-size towel, a clothes brush, and a pocket in which can be carried medicine or other accessories. The pillow can also be used to advantage for carrying necessities on a picnic or at the seashore.



Weatherproof Outdoor Bowling Alleys

OUTDOOR bowling alleys installed not long ago at Manhattan Beach, N. Y., were made practicable by the use of a new alley-surfacing material said to be unaffected by

rain, strong sunlight, or extreme changes in temperature. The conventional gutters lining the sides of the alleys also serve as drains to carry off water during rainstorms.

Radio Compass for Planes Uses Broadcast Stations



New radio compass. Any broadcast program is its beam

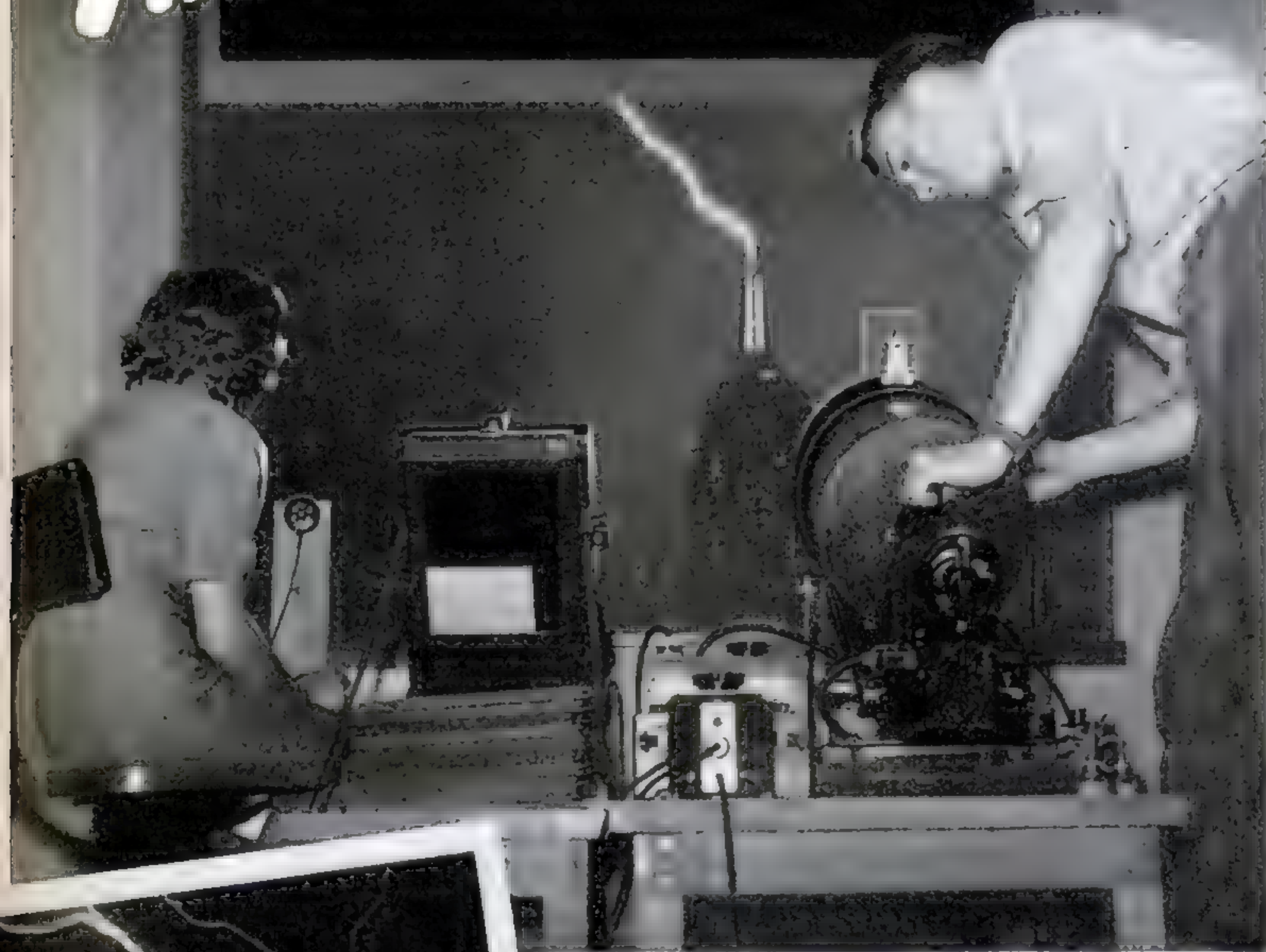
BROADCAST musical programs can guide airplane pilots unerringly to their destination when they use a new homing device developed by Henry Wolff, of San Francisco, Calif. A pilot heading for New York City, for example, would tune in a New York station. As long as he heads directly for the station, the program will be heard clearly. A visual tuning device supplements the aural program signals.



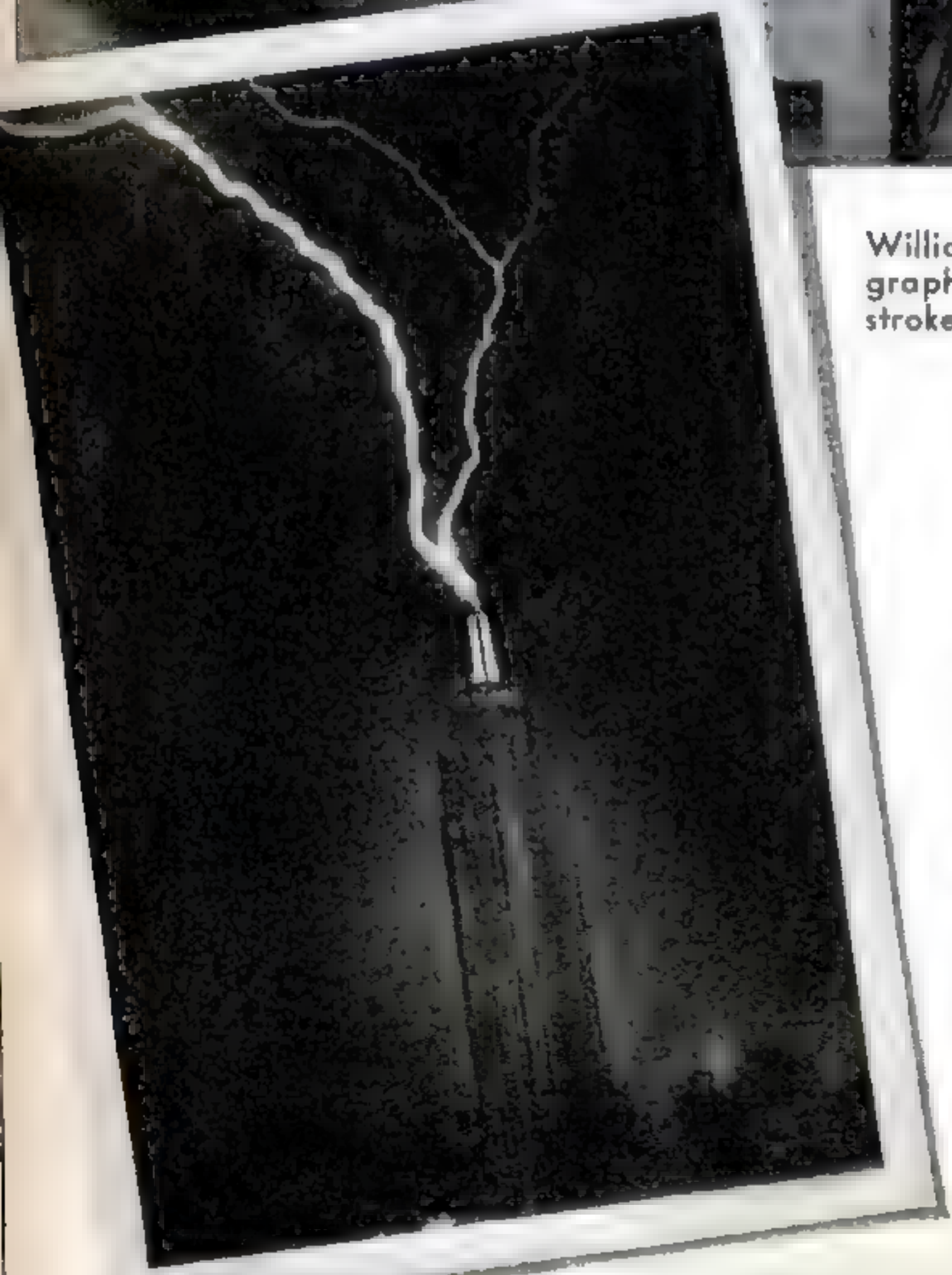
Filter Pipe Is Smoked Through a Cigarette

MORE than eighty percent of the nicotine in tobacco smoke is said to be removed by a filter pipe recently announced. Smoke drawn from the pipe bowl to the mouthpiece passes through two halves of a cigarette, which act as filters to absorb most of the nicotine.

Thunderbolt Hunter



William H. Eason adjusting a high-speed camera to photograph lightning. The picture at left shows two distinct strokes on the lofty tower of the Empire State Building



TRAPPING lightning on film from a skyscraper laboratory thirty-nine stories above one of the busiest corners in the world, at Forty-second Street and Fifth Avenue in New York City, is the unique task assigned to William H. Eason, young General Electric scientist. On call twenty-four hours a day, this thunderbolt hunter operates a battery of special cameras, each trained with hair-line accuracy on a four-foot lightning rod topping the tower of the 1,250-foot Empire State Building, eight blocks away.

Aided by photographs and other data obtained on the lightning strokes that hit the tower—more than ninety have sizzled to its steel tip in the last four years—research workers directed by K. B.

YOUNG SCIENTIST FILMS LIGHTNING FROM ODD SKYSCRAPER LABORATORY

McEachron, of General Electric's high-voltage laboratory at Pittsfield, Mass., hope to solve the mystery of what lightning actually is and exactly how it behaves.

Getting this data is the job that keeps Eason on the alert every waking hour during the lightning season from May to October. With his wife, who helps during his busiest moments, he lives in a near-by hotel, and seldom wanders more than a few blocks from the immediate vicinity. Even when he goes to a movie, he ducks out every half hour to snatch a quick glance at the sky for evidence of gathering clouds.

At night, he relies on the Public Service Corporation, a New Jersey electric utility firm, to tip him off on approaching storms, which almost always sweep north-eastward toward New York. When a jangling phone wakes him at three or four in the morning, with the news from a powerhouse dispatcher that a storm is on its way, Eason hops out of bed, jumps into his clothes and goes into action.

Racing over to the Empire State Building, Eason speeds to the top in an express elevator and starts the motors of two automatic cathode-ray oscillographs connected to the tower lightning rod to make wave charts showing the cur-

rent strength and duration of the strokes that hit the building. Whisked down 102 floors to the street level, he hops a taxi and rushed to the Forty-Second Street laboratory. Within a minute he has the windows open and the camera motors purring smoothly.

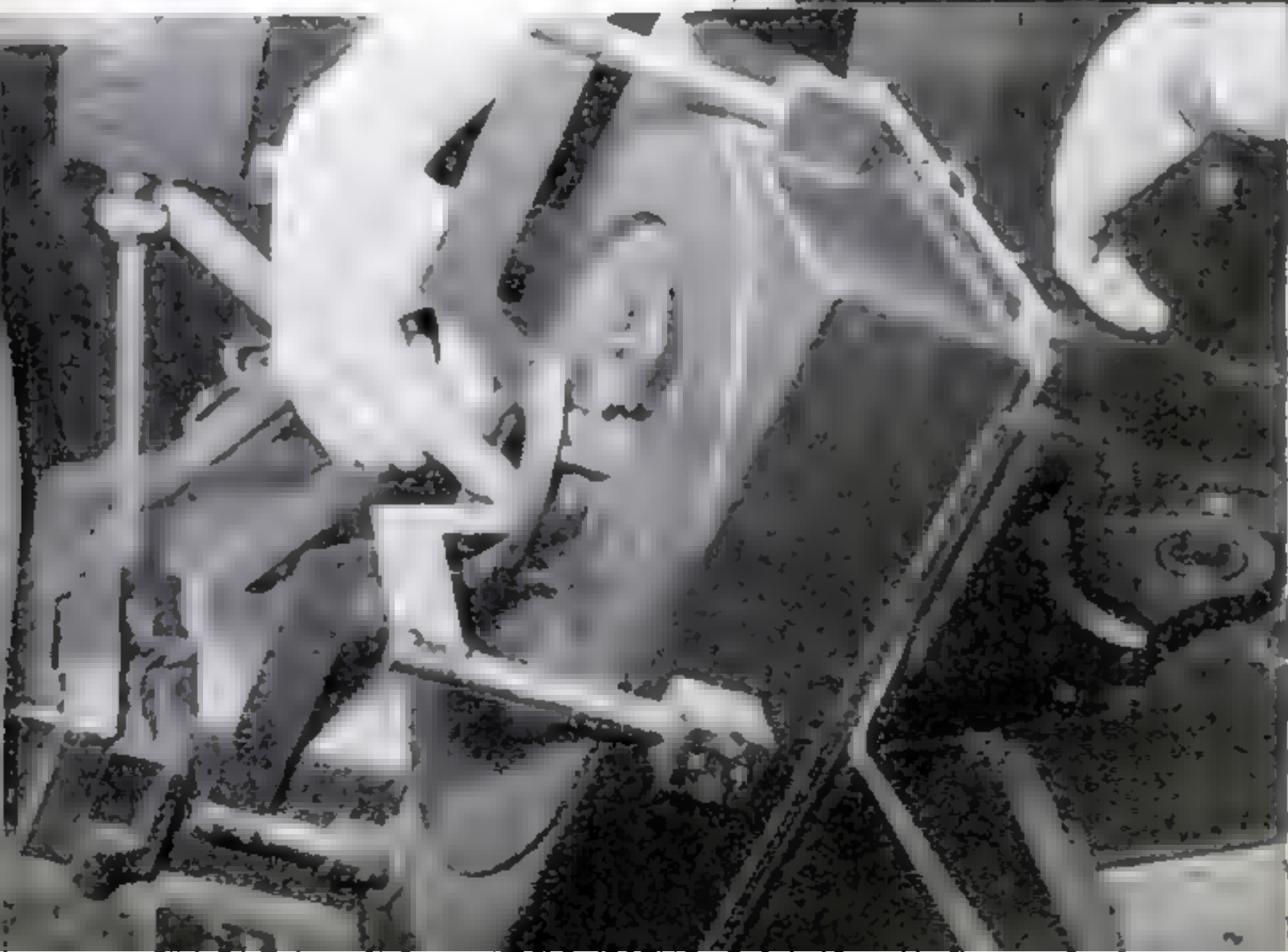
Eason's next operation is to throw a double-pole electric switch. A buzzing sound in a telephone receiver tells him that an automatic camera, started by remote control, has begun to operate on the roof of a building west of the Empire State, where it

By
E. W. MURTFELDT

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This curious picture was made with the slow-speed camera at left, which has a fixed central lens (indicated by finger) and a second lens which revolves around it once every two seconds





This is the camera room high above the roof tops of New York City. Eason is seen changing plates in the slow-speed camera



Cleaning the lens on a remote-control camera set on a distant roof. This auxiliary unit, permanently focused on the tower, films bolts from another angle

Eason throws a switch to start the automatic camera. A buzz is heard in the phone as it starts



will film the lightning from another angle. The thunderbolt hunter is now ready to photograph any flashes that snap at the tallest lightning rod in the world. Eason takes his post by the window, voicing his observations on the storm into a microphone, which relays his words to a cylinder-type recording machine. Near-by is a special timing mechanism with which he can punch out on specially printed cards the exact time

when the lightning photographs were taken.

When the storm reaches its peak, Eason is working at top speed, observing, punching time cards, changing camera plates, shifting film cylinders, and keeping up a running oral account of the storm's progress. With the last faint roll of receding thunder, he begins to relax, for now he has little more to do than look forward to three or four days of transcribing notes, developing films, correlating oscillograph data, and checking over every piece of apparatus in preparation for the next onslaught of lightning.

When I visited the skyscraper laboratory—I was told to come only if no storm clouds were brewing—Eason explained the workings of two of the three separate cameras that are trained on the Empire State tower. The first, designed to measure the velocity of the lightning strokes, is a high-speed camera that takes seven shots on special film that is whirled in a motor-driven cylinder at a speed of 3,600 revolutions a minute.

Next to this camera speedster is a slow-speed camera with a fixed central lens, around which a second lens revolves once every two seconds. This instrument helps determine the length and the duration of strokes. On the far side of the room is a huge multiple-lens camera, with a motor-driven film that moves one revolution a second. Further details concerning the operation and purpose of this specially designed giant the

experimenters are not yet ready to reveal.

From this impressive array of scientific equipment, a mass of valuable data is being accumulated. And sandwiched in among the research materials is a host of amazing and curious lightning facts. When lightning strikes the Empire State Building, for example, the main current flow is practically always *upward*. On one day, lightning hit the tower fifteen times, and then struck it only nine times more in the next four months. Tower guards who have shoved their hands out of a tower window when charged storm clouds were near-by, have seen sparks stream from their fingertips with a noise like escaping steam, while their hair literally stood on end.

Aided by the material Eason gathers on this unusual assignment, General Electric scientists are learning how to duplicate natural lightning more accurately. This information they plan to use to test the various means now employed for protecting transformers, power lines, circuit breakers, and other high-voltage equipment against lightning, and to aid in developing new safeguards against destructive thunderbolts.



Mrs. Eason, who helps her husband on "busy days," punches cards on a timing device to show just when shots are made. He records progress of storm

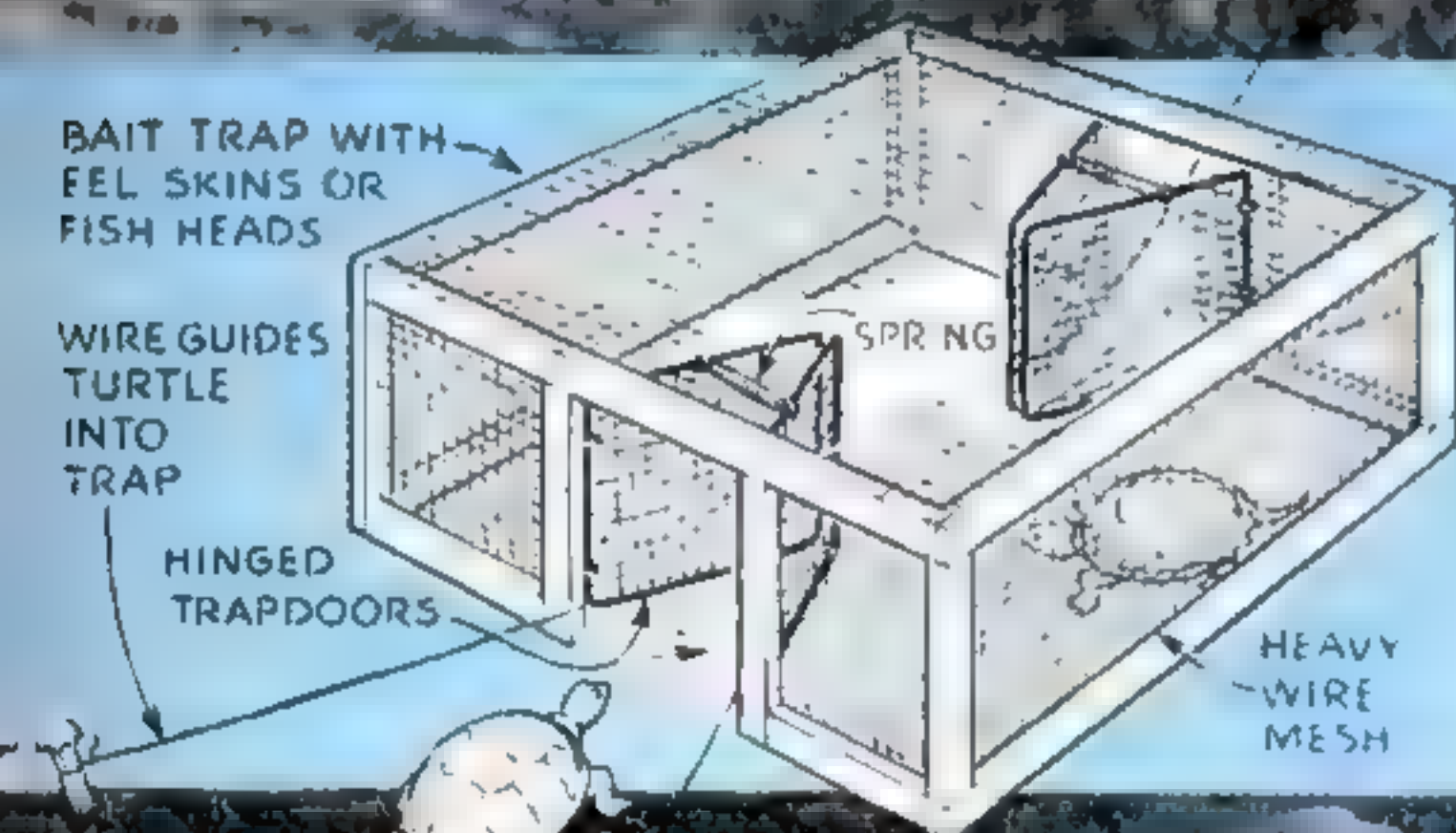
Inserting film in the revolving cylinder of the high-speed camera. The metal tube at the front carries air from a blower to help cool the rapidly whirling film



Turtle Trapper Snares Underwater Killers

MAINTAINING the position he has earned as public enemy No. 1 to the snapping turtles of Long Island is the task that keeps Arthur L. Lucas, of Center Moriches, N.Y., busy. For five years, Lucas

has waged war on these underwater killers, which he feels are probably the greatest menace to the game fish and wild life of the region. To date, he has bagged more than 19,000 turtles, ranging in weight from four to fifty-seven pounds. Since sixty percent of this number were females, and the average turtle hatch is forty eggs, Lucas figures he has eliminated a grand total of over 300,000 snappers. In addition to the more orthodox methods used by other hunters for catching turtles, Lucas has devised a trap made of heavy wire mesh with a V-shape gate at each end, which he places across a stream. Attracted by bait of fish heads or eel skins, turtles are guided into the trap gates by wires stretched along the stream bed. Although making money is not his first interest, Lucas packs his turtles into barrels and ships them off to the market to help defray the expenses of the relentless war he is waging against them.



Snapping turtles are "in the bag" when A. L. Lucas starts after 'em

Below, Lucas and his turtle trap. Drawing explains how it operates





Brush Holds Powder for After-Bath Use

DESIGNED for use after the bath, a new dressing-table accessory for women sifts scented powder, through holes like those of a salt shaker, upon a brush with long, soft bristles. A reservoir within the handle holds a month's supply. Since the handle is made of transparent plastic, a glance shows when it is necessary to insert refills, which are supplied in glass cartridges. When not in use, the powder applicator is shielded from dust by a transparent cover.

Portable Reaction Timer Tests Car Drivers

WHOSE fault was the accident? Besides testing brakes and controls of a car involved in a crash, police can now check up on the driver himself. A new "interval timer" is attached to the gas pedal and brake, the motorist shows how he attempted to stop his car, and a telltale dial indicates to the nearest hundredth of a second how quickly he reacted.



Attached to a car's gas pedal and brake, this little instrument shows how fast the driver reacts to danger



Silent pneumatic drill being demonstrated in a London street

"Silent" Air Drill Spares the Nerves of City-Dwellers

NO LONGER need city thoroughfares resound with the nerve-racking clamor of pneumatic drills, when a new pipe is laid or a leak repaired, if a new British invention proves successful. Called a "silent" air drill and recently given its first tryout in a London street, it was declared by observers to be inaudible above the sound of passing traffic. Details of its method of operation have not yet reached this country, but it is reported to dig through concrete at twice the speed of standard types of drills, and to require no physical effort on the part of the workman operating it. The newly developed air drill is shown in the illustration at the left undergoing a demonstration in a London thoroughfare to prove its quiet operation.



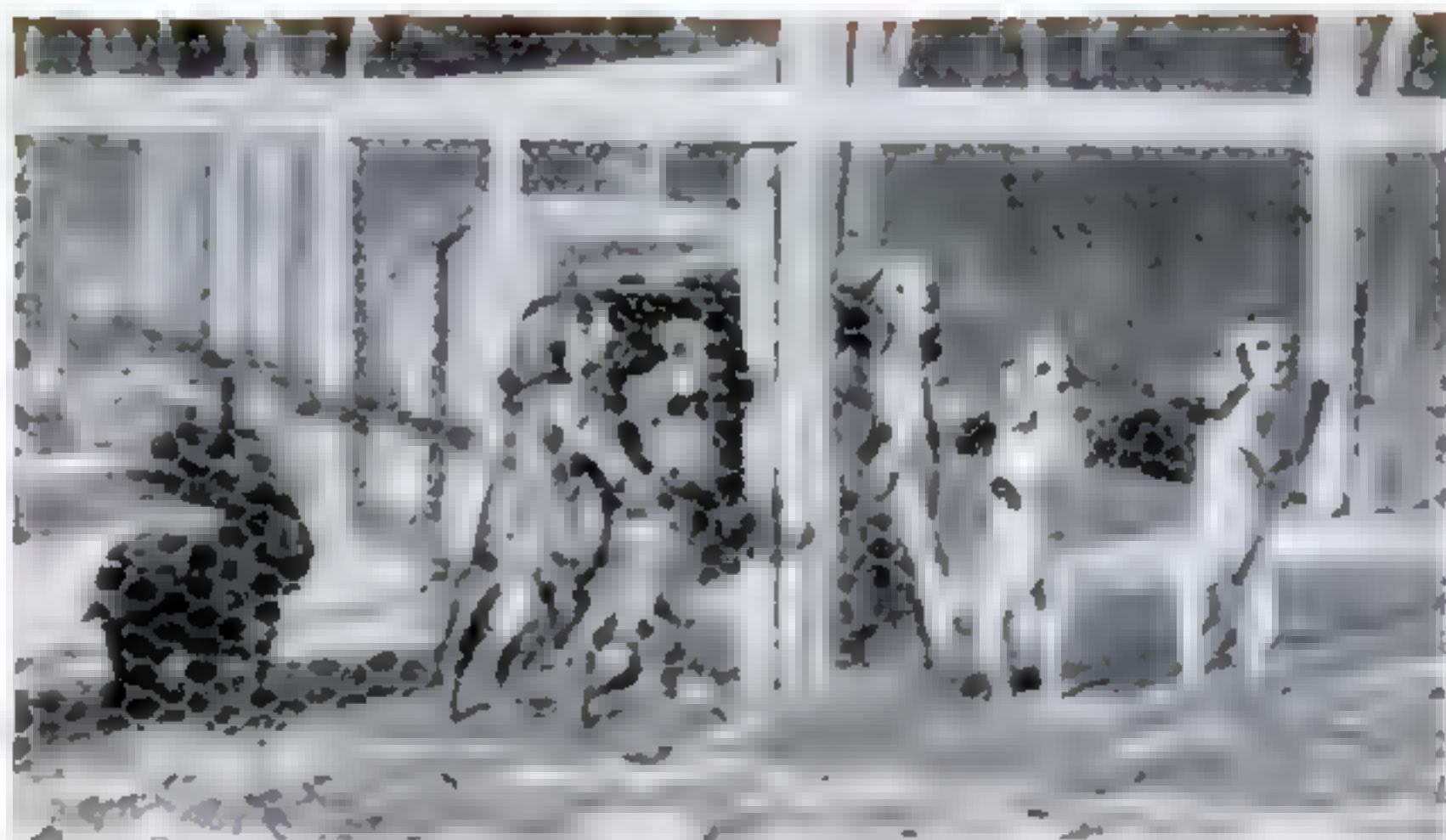
Wire-floor dog pens on the Connecticut farm of Leon F. Whitney. The floors are a foot above the ground

Wire-Walking Pups

NOVEL PENS KEEP DOGS HEALTHY

RAISING strong, healthy puppies in pens fitted with wire-mesh floors elevated a foot above ground level, as a protection against parasites, is the accomplishment of Leon F. Whitney, Connecticut biologist and dog expert. Recognizing the fact that turkeys, chickens, ferrets, raccoons, and other animals were given a better start in life by being brought up on wire mesh, Whitney adopted the plan as an experiment in dog raising several years ago. Now, having raised more than 300 hale and hearty puppies on wire, he is ready to call the experiment an unqualified success.

At first, Whitney had serious doubts as to what the wire floors would do to sensitive puppy paws. The tiny feet of the first pup he placed in a wire-floor pen promptly fell through the one-inch-square mesh. But within a week, a litter of young cocker spaniels were running about the pen, never once stepping through the holes. And in-



Full-grown dogs back on the ground after their puppyhood on wire

stead of their paws being ruined, as some kennel visitors expected, the spaniels' feet were actually as strong as, if not stronger than the feet of other dogs raised on solid ground.

Moreover, the wire-walking pups grew faster and looked healthier than a comparison group he raised on sand. The reason for this, he explains, is that more dogs die in early puppyhood from intestinal

parasites transmitted from one to another by means of their droppings, than from any other cause. With wire-mesh floors, the droppings fall through onto hay or straw below, which can easily be raked up and disposed of, leaving the pen itself clean and sanitary. Incidentally, he remarks, this is a much more economical method than the old one of cleaning up dog runs and changing newspapers constantly.

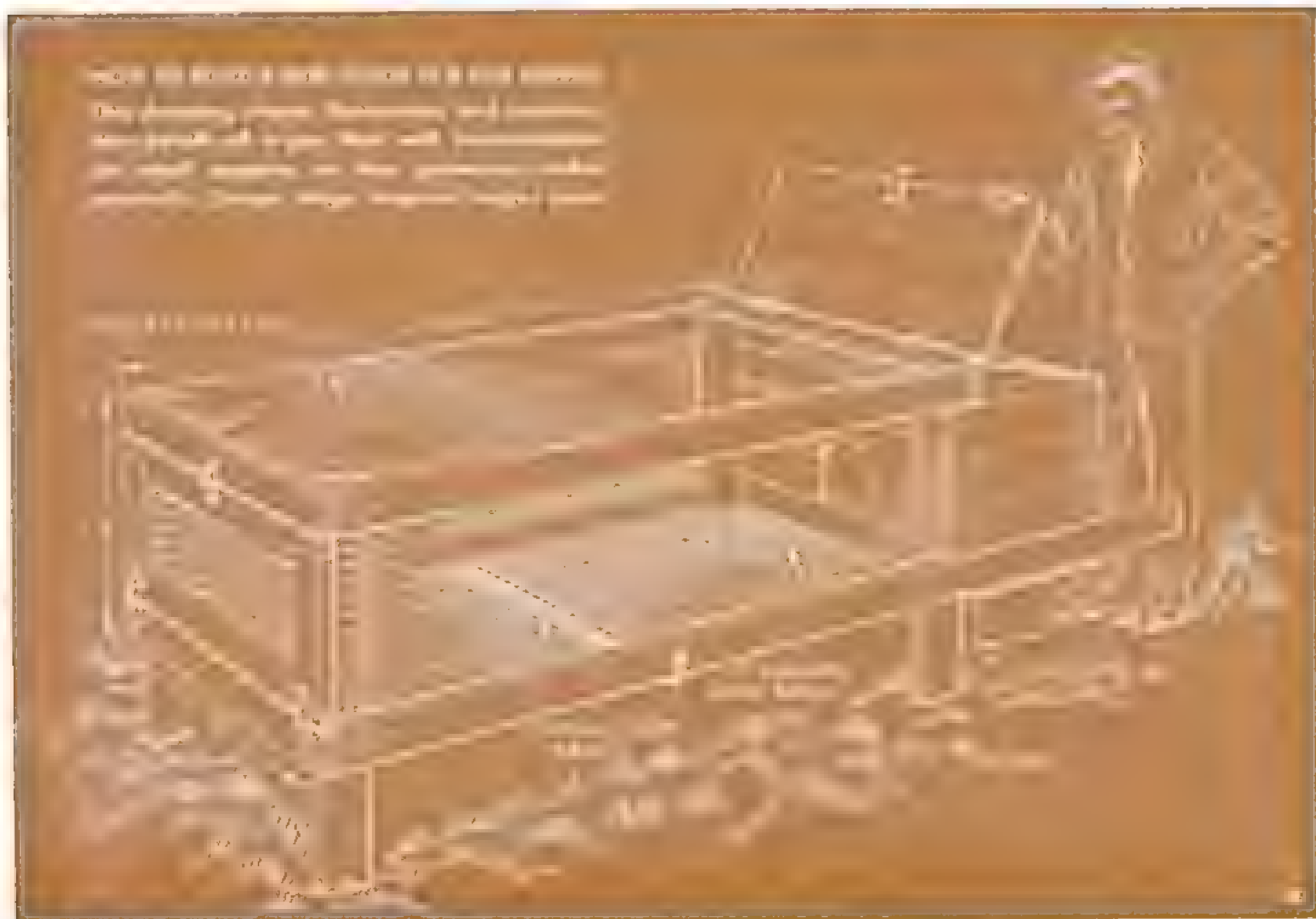
Guided by his earlier tests, Whitney built new and larger pens, eliminating

every possible corner where droppings might catch, and started raising larger dogs. Now he has fifteen pens, some of which accommodate such large breeds as greyhounds, bloodhounds, and great Danes. The pups stay out of doors even in winter, the wire-floor pens preventing them from tracking mud, slush, or snow onto their bedding in the inclosed wooden houses attached to the pens.

Another advantage of the wire pens, Whitney points out, is the saving in space.

"For those who want to keep dogs in a city back yard," he says, "here is the ideal solution. Litters of puppies can be kept in a pen with a minimum of trouble to their owner and a minimum of annoyance to neighbors. For there is no bad odor, and we have found that we can discourage crying and whining merely by tapping on the wire under their feet."

First wire pen built. The cocker spaniel has puppies in the hutch

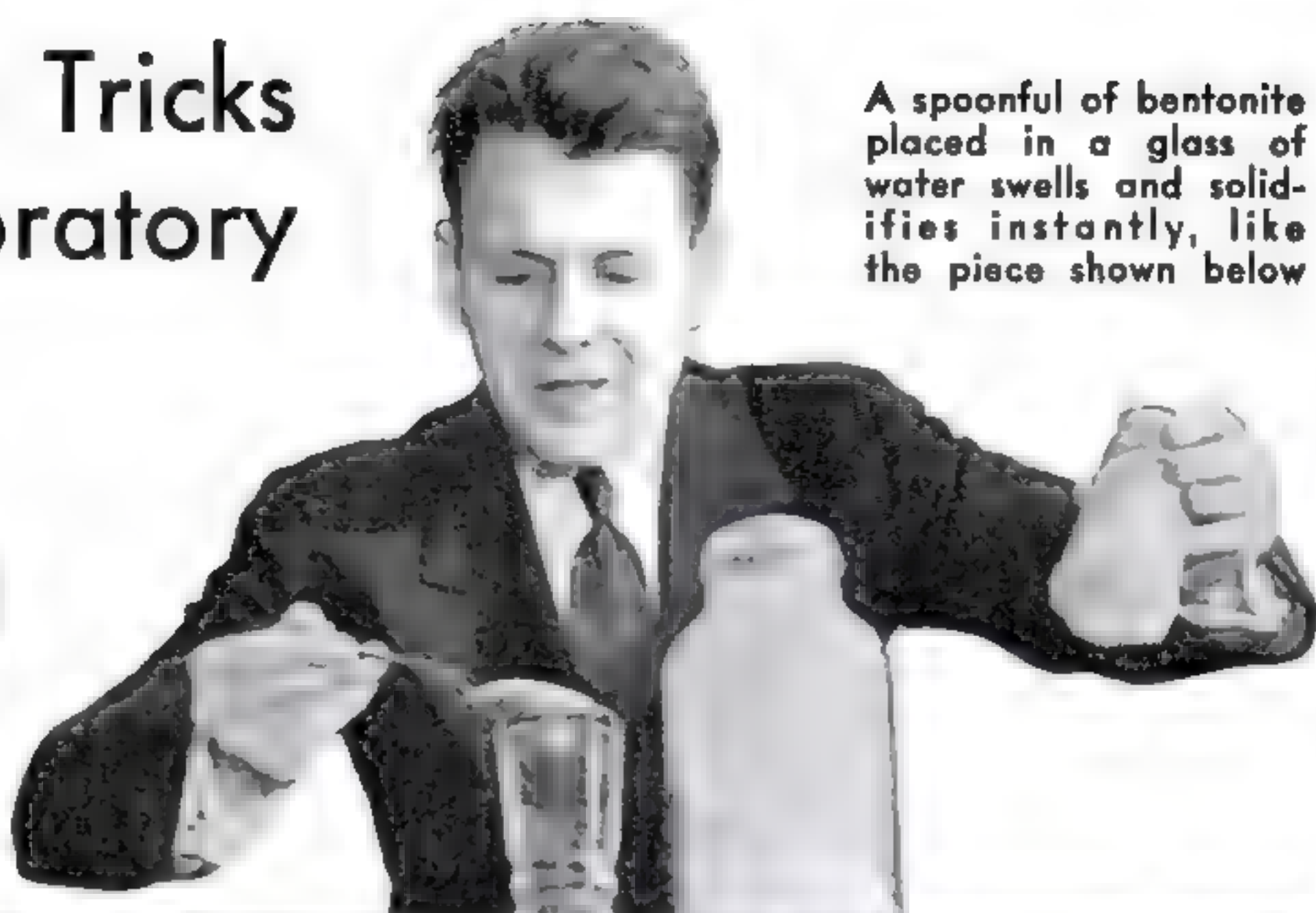


Minerals Do Tricks in Odd Laboratory

A spoonful of bentonite placed in a glass of water swells and solidifies instantly, like the piece shown below



"Puffed" slate floats on water, unlike plain slate



Poured into this apparatus, salt sea water passes through mineral filters that purify it

Microporate, a material made of lime and silica, can be nailed and sawed like wood



ROCKS that bend, or float in water, or can be sawed like wood, are the strange materials that occupy the time of scientists in a laboratory of the U.S. Bureau of Mines at College Park, Md., whose business it is to study and develop various queer minerals for commercial and scientific uses. One of the most curious of the specimens is slate rock that floats. Ordinary slate, which would instantly sink in water, is heated to a high temperature. It puffs up, and its normal free carbon changes to carbon dioxide imprisoned in sealed cells. The slate then floats. Bentonite, a new mineral material, is another queer performer. Dropped into water, the material swells up and jells almost instantly, which makes it a valuable substance for stopping underwater leaks where ordinary cement would wash out as fast as it was poured. Microporate, another mineral made of lime and silica, can be sawed, nailed, and otherwise worked like wood, but

has the additional advantages of being extremely light in weight and also fireproof. In one amazing laboratory demonstration, a bucket of salt sea water is poured into a system of bottles and glass tubes, in which it passes through two special mineral filters. When it emerges, the water is no longer salt.

Odd Ice Boat Has Pivoted Sail of Wood

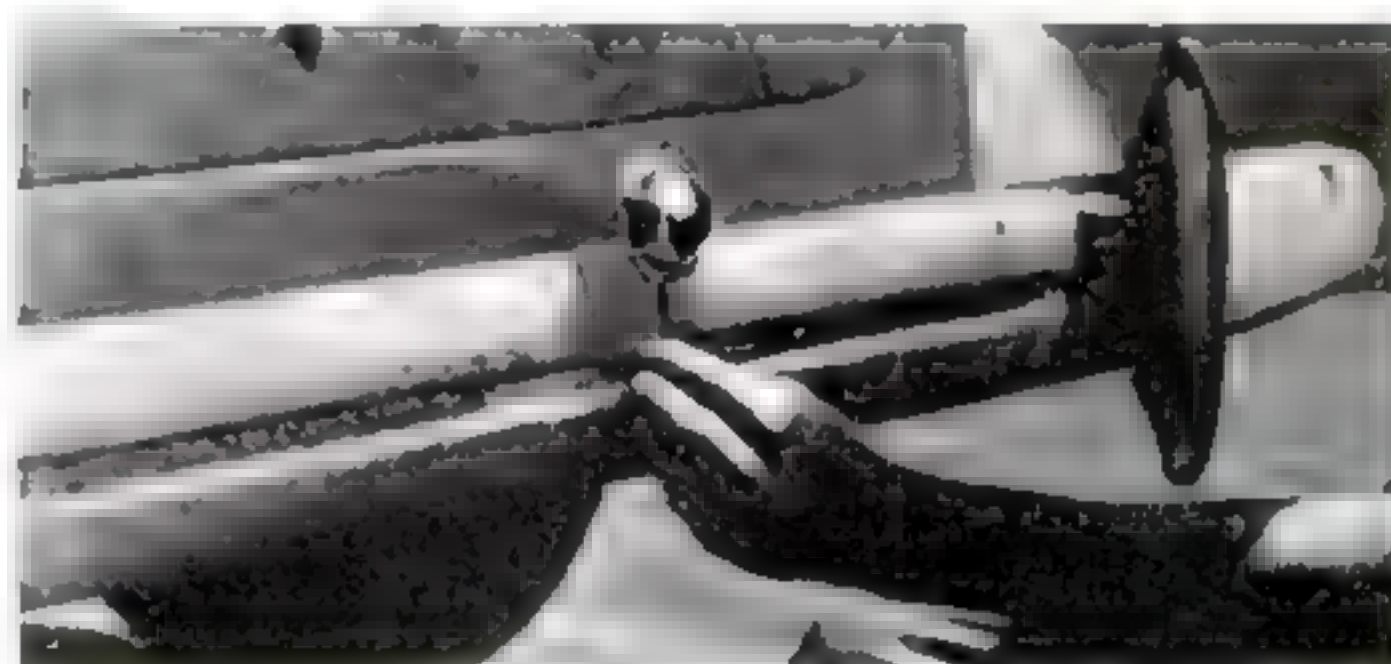
WOOD replaces canvas in the sail of a novel model ice boat designed by a European inventor. A radical departure from conventional designs, the original of this streamline craft has a sail made of lightweight, laminated wood, fashioned in somewhat the same manner as the wing of an airplane. The sail is not controlled through sheets, or guide ropes, but is trimmed by means of a gear mechanism acting on the mast, to which the wooden sail is permanently attached. Although the sail swings at an angle of only a few degrees to either side of the middle of the boat, this is no disadvantage, since ice boats always sail close-hauled, and the wooden sail provides ample wind area to drive the craft over the ice at high speeds. The ice boat's cockpit is protected from the weather by a sliding cover made of a transparent shatterproof material.



Model of novel ice boat. A gear moves the rigid wooden sail

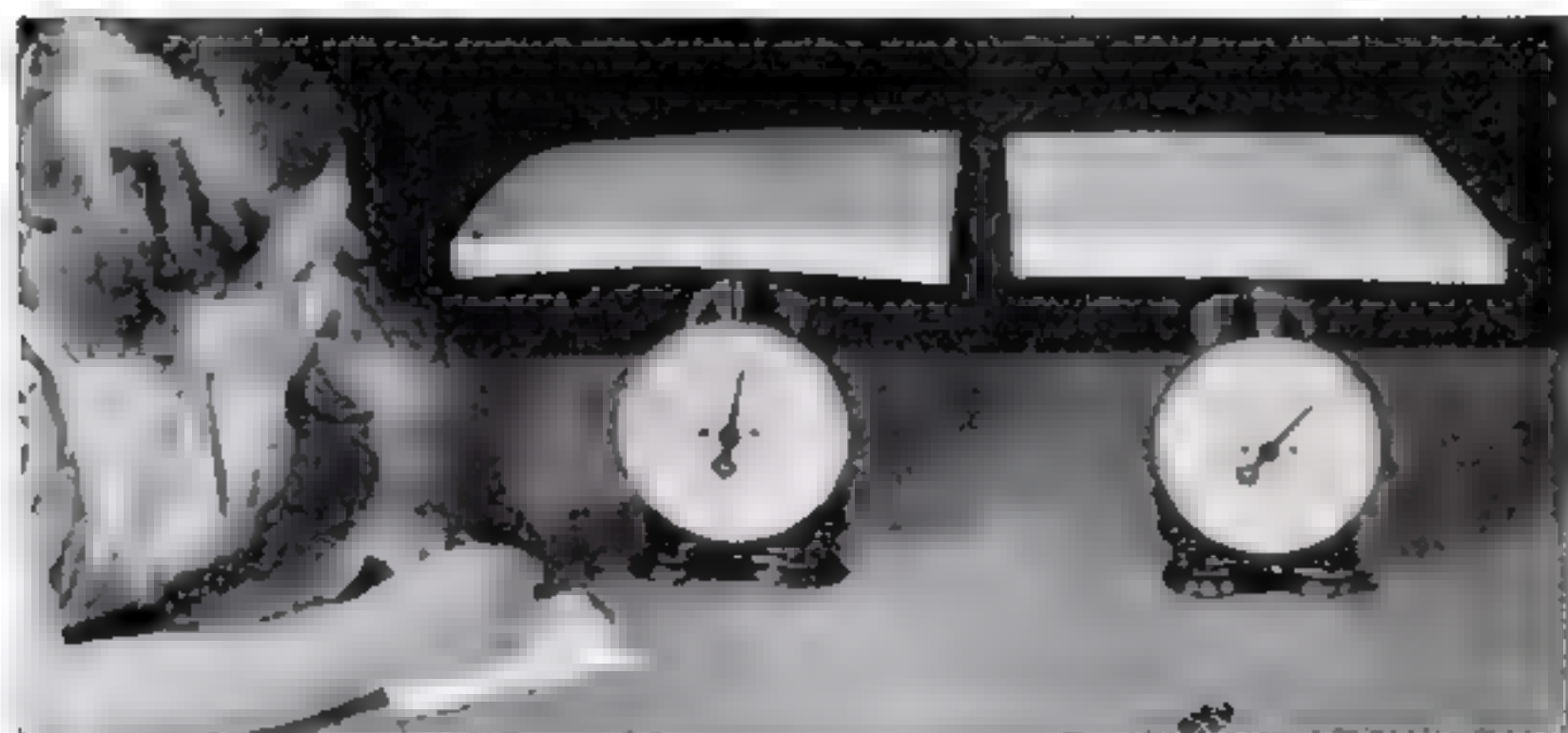
Car Reflector Jiggles

EASILY attached to any part of a car, a novel reflector button just marketed jiggles constantly when an automobile is under way to gain the maximum attention of drivers of approaching cars. The button is attached to a steel spring that is resilient enough to vibrate the button even when the car is moving over the smoothest highway.



This reflector button jiggles to get attention

Nitrogen Gives Light Sponge Rubber



Comparing weight of new sponge rubber and of ordinary type

ONLY one third as heavy as ordinary sponge rubber, a new type of rubber now available is said to be made up of millions of tiny sealed cells containing nitrogen. Since no oxygen can reach the interior of the product, and thus forward the process of oxidation which is rubber's greatest enemy, the new material is said to have superior wearing power and durability. In addition, the new rubber is declared to be exceptionally resilient.



Robert Weisel adjusting the chain drive to lift toy cars up an incline of his sixty-five-foot-long model roller coaster

High-School Boy Builds Model of Roller Coaster

ROCKETING at high speed over sixty-five feet of twisting track, tiny cars whirl around an amazing scale-model roller coaster built by Robert Weisel, High Land, Pa., high-school student. In the photograph above, Weisel is shown adjusting the chain drive that lifts the cars up one of the inclines.

Sax Players Get Reeds of Plastic Material

MOISTUREPROOF and resistant to splitting, reeds made of a new plastic material for use in saxophones, clarinets, and other reed instruments are said to be equal in tone quality and volume to cane reeds now generally used. One of the new plastic reeds is shown at right, compared with a cane reed.



Rolling Schoolhouse Tours the Country

STUDENTS from a middle-western school, living in a fully equipped "highway yacht" and assembling for class each day in a different town, are traveling about the United States to visit historic sites and learn by observation as well as instruction. The school on wheels in which they are making the journey forms a combined dining hall and dormitory. Each night, the truck moves on to a new location.



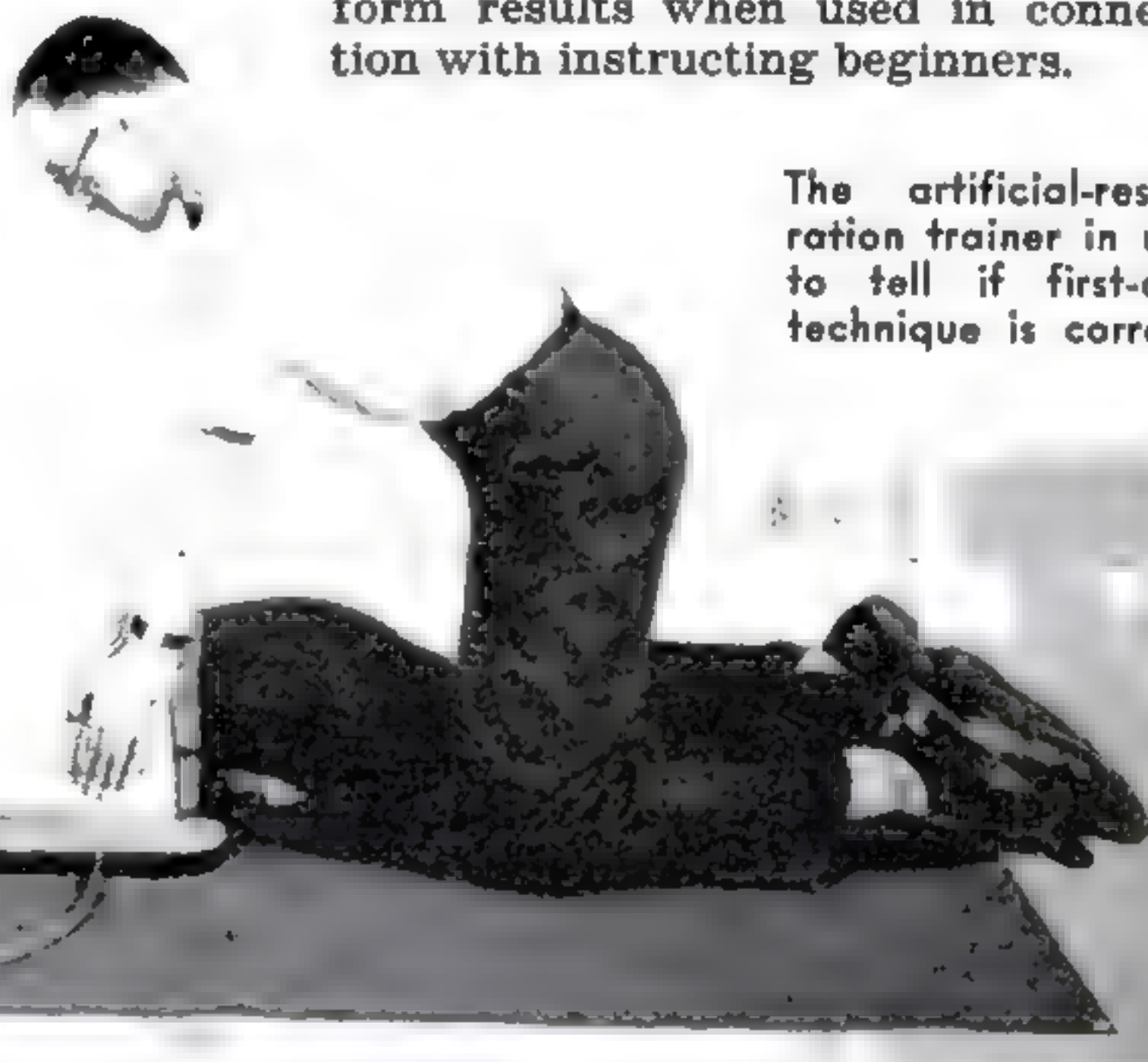
Students in the school on wheels lounging on their bunks. The bus travels during the night, parks by day



Machine Trains Students in First Aid

AUTOMATICALLY recording the exact pressure applied and the amount of air expelled from the lungs, a new mechanism aids in training beginners in the technique of artificial respiration. The device, which is housed in a compact case measuring nineteen by sixteen by fifteen inches, records on a graph data about the work of each student during a five-minute test. Variations in timing, in pressure,

and in the depth of a patient's breathing are clearly shown, enabling the beginner to see exactly where he is making mistakes. The innovation also provides a quick and accurate means of checking up on the work of those experienced in reviving victims. According to the manufacturer, the device saves time and produces more uniform results when used in connection with instructing beginners.

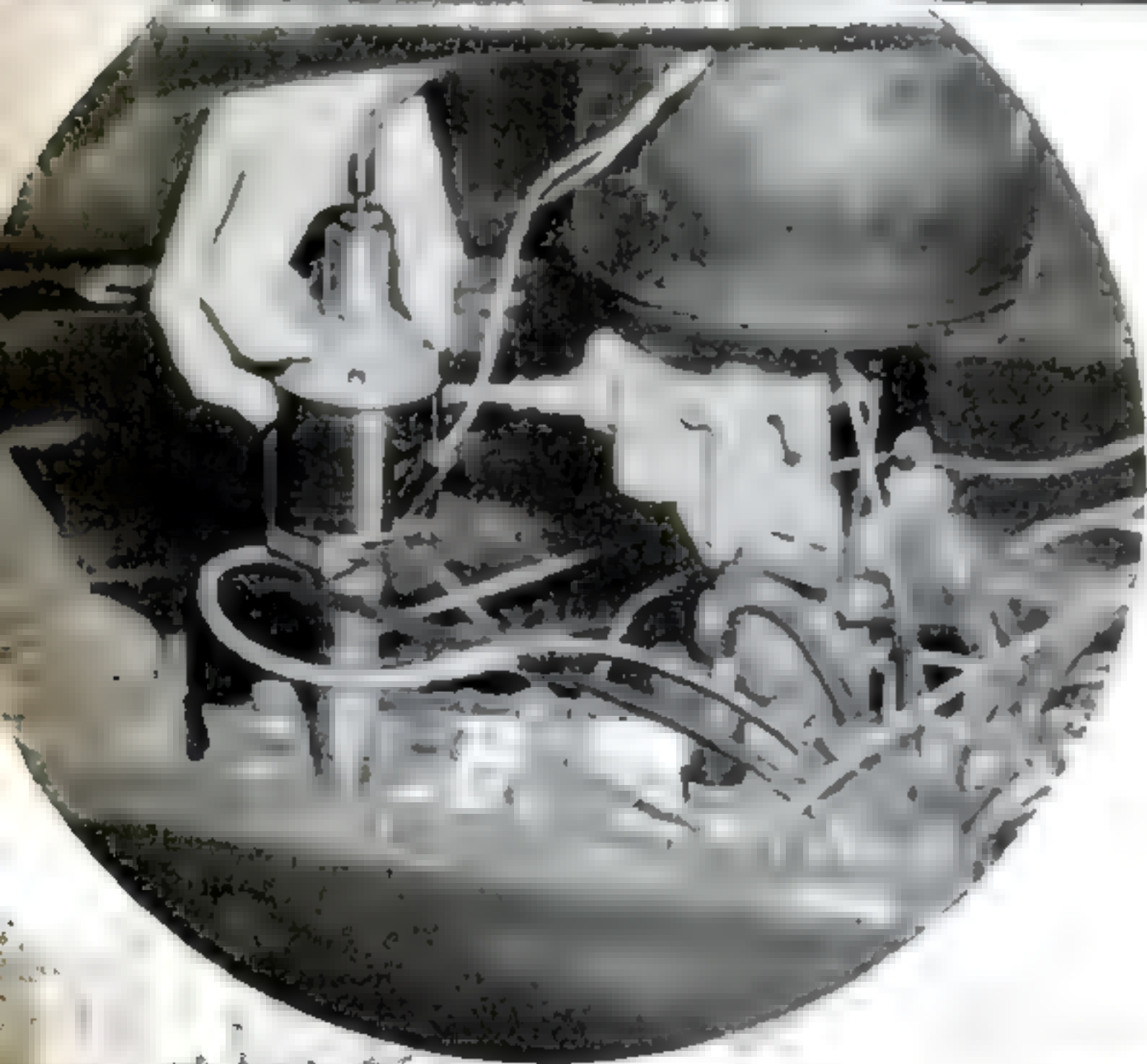


The artificial-respiration trainer in use to tell if first-aid technique is correct

Gasoline Gets the Third



○ N A vast natural proving ground in southern California, embracing four mountain ranges, two deserts, and several dry lake beds, sun-baked research engineers of the Ethyl Gasoline Corporation are piling up staggering mileages on a fleet of trucks, tractors, and passenger automobiles to gather data on fuel consumption, engine performance, and other factors that may provide clues to increased power and economy for all types of gasoline-driven motors. Rumbling at a snail's pace around a make-believe plowed field on the bed of a sun-scorched dry lake, two farm tractors have already amassed a total of 8,000 miles. A heavy truck, groaning under a thirty-ton load of sand, has



DRIVING TO SAVE GAS. As this test car travels over the proving ground, the engineer observer watches a gauge that shows gasoline consumption, and a panel registering car speed and wind velocity

SAMPLING COMBUSTION PRODUCTS. With the ingenious valve at the left, samples of combustion products can be sucked into a glass bottle for analysis to determine weight of fuel and air in cylinder

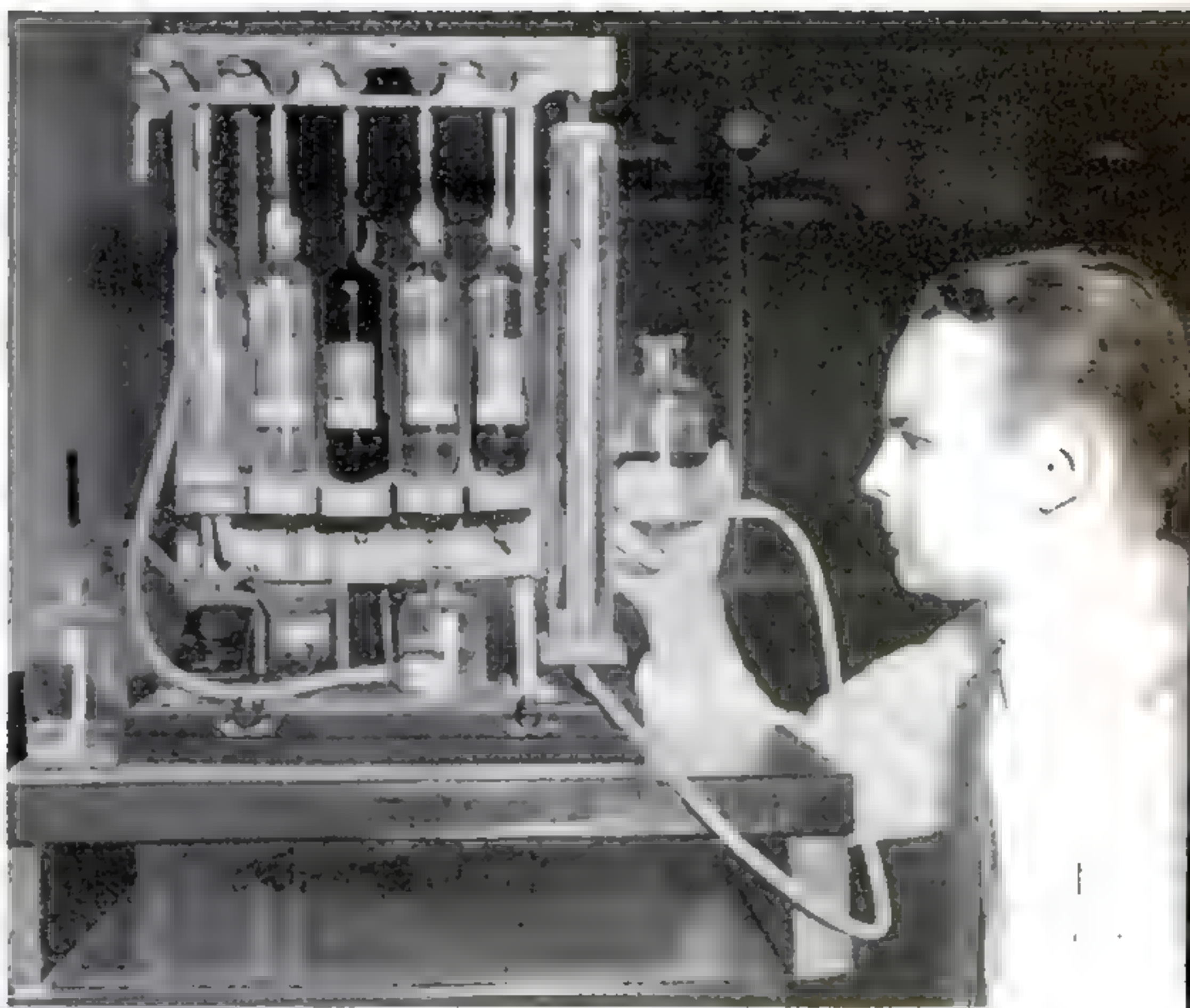
MILE-EATING TRACTORS. These two tractors, one towing the other as shown below, have piled up a total of more than 8,000 miles in tests that may mean greater power and economy for farmers



Degree

SCIENTISTS WEAR OUT CARS TO GIVE YOU MORE MILEAGE

been driven more than 250,000 miles—equal to ten times around the globe—over courses ranging from 200 feet below to 7,000 feet above sea level. Passenger cars, carrying directional wind vanes, speed around a dry-lake course with, against, and across the wind, constantly accelerating and decelerating between ten and sixty miles an hour. These test cars have been driven a total of over 2,000,000 miles.



SPEEDOMETER FIFTH WHEEL. As a test car speeds around a circle on a dry lake, this wheel follows the contour of the ground to measure the speed. The wheel drives a magneto connected to a voltmeter calibrated to register in miles an hour.

AUTO WEATHER VANE. The box mounted on the car at the right houses an anemometer to gauge the speed of the wind, while the vane on top registers on a dial the direction of wind with reference to the direction of travel. In this test, acceleration and deceleration of cars are checked between ten and sixty miles an hour.

MORE POWER TO YOU is the purpose of chemical tests like this, in which a sample of the exhaust gases taken from a cylinder are analyzed to find the amounts of carbon dioxide, carbon monoxide, and oxygen they contain.





Scene in a road-test car. Note the distortion by sheet glass in the side windows, and clear image in the plate-glass windshield

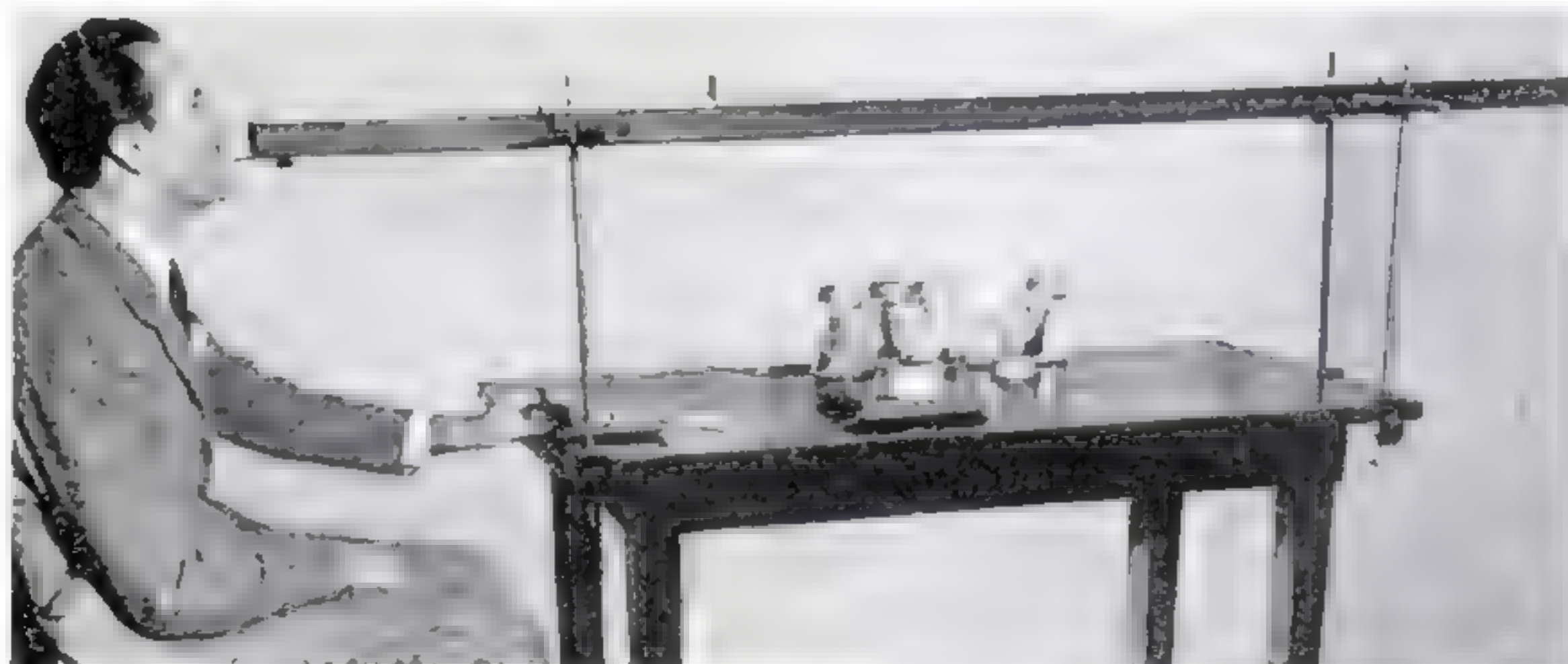
Tests Measure Eye Strain Caused by Car Windows

FOLLOWING a ten months' series of intensive experiments with a battery of ingenious optical testing machines in the laboratory and on the road, Dr. Andrew H. Ryan, of Chicago, Ill., working in conjunction with the research staffs of the Fisher Body Division of General Motors and the Libby-Owens-Ford Glass Co., recently revealed that passengers looking at an angle through the side windows of closed cars suffer sixty-two per cent less eye fatigue when the automobile is equipped with safety plate glass than when safety sheet glass is used. Distortion from surface irregularities in sheet glass, which is not ground and polished like plate glass, was found to cut down the ability of passengers to read highway signs. In comparison with plate glass, the results indicate, sheet glass produces double the number of eye-strain symptoms, and reduces the ability to judge distances by about eighty percent.



This device tests the ability of the eyes to read letters and figures exposed briefly behind glass of different kinds

Another of the odd instruments used in the tests. It measures the effects of eye fatigue on the subject's vision



Skater Performs on Tiny Ice Rink in Store Window

WHAT is said to be the world's smallest ice-skating rink was recently constructed in a display window of a New York City furniture store as a novel means of letting passers-by and possible customers know about the cool shopping conditions afforded by the store's new air-conditioning plant. Measuring only twelve feet long and six feet wide, the rink was placed immediately behind a sidewalk window, and decorated on three sides with evergreen branches and artificial snow to give it an outdoor effect. A figure skater was then hired to perform on the tiny rink, as shown at the right.



This miniature ice carnival made a novel display for a store window

Jinricksha Lawn Mower Saves Time (and Work)

ACCORDING to Mike Steddum, groundskeeper at the University of Oregon in Eugene, efficiency and not laziness is the reason why he constructed the odd jinricksha lawn mower pictured below. Starting with a gasoline-driven hand mower, Steddum secured an old wheel chair and hooked up the two. Now he can relax at his work of cutting grass on the athletic fields, and still do the job faster than if he walked.

Mike Steddum hard at work operating a combination wheel-chair lawn mower

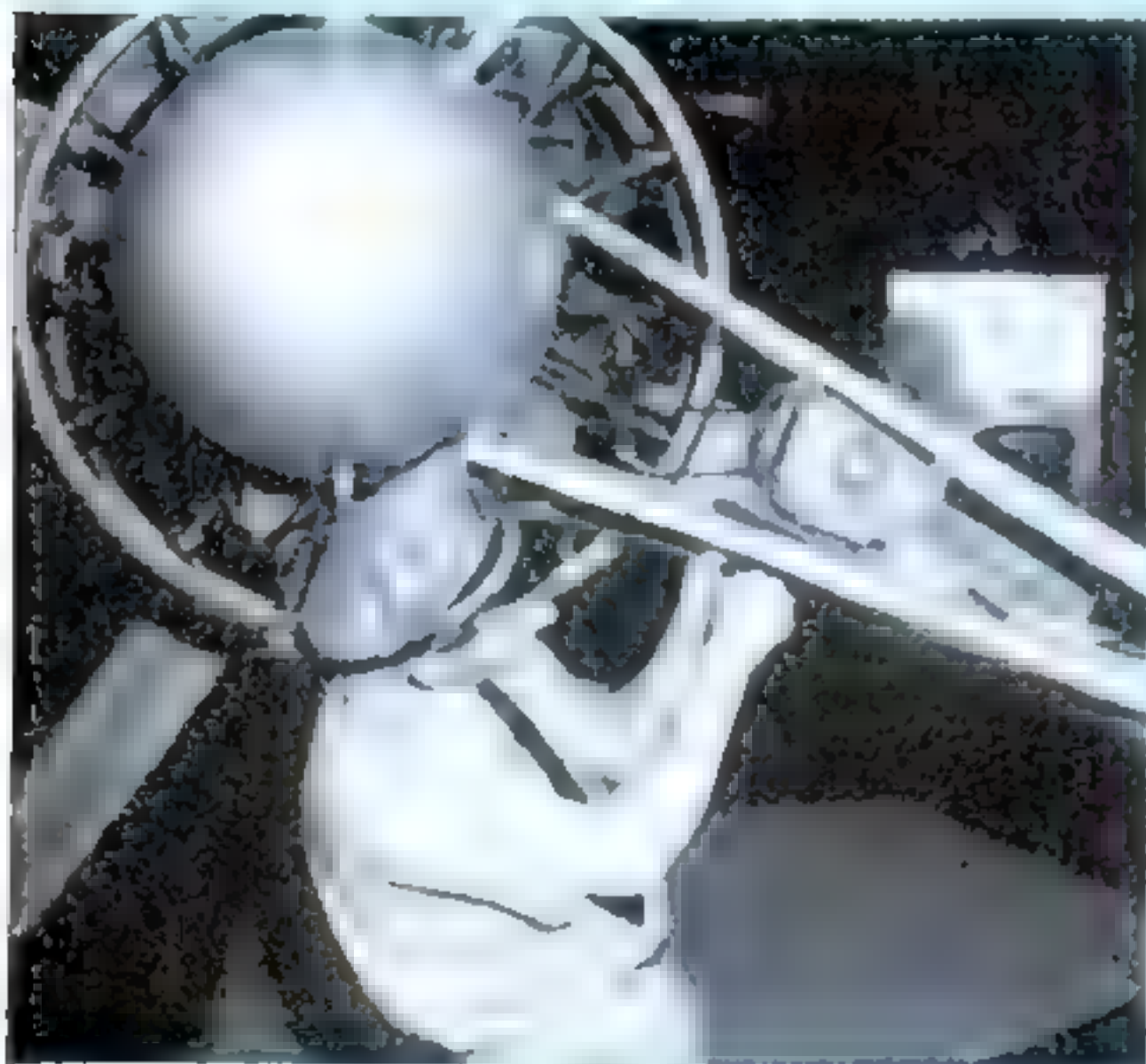


Tiny Blimpier Carry

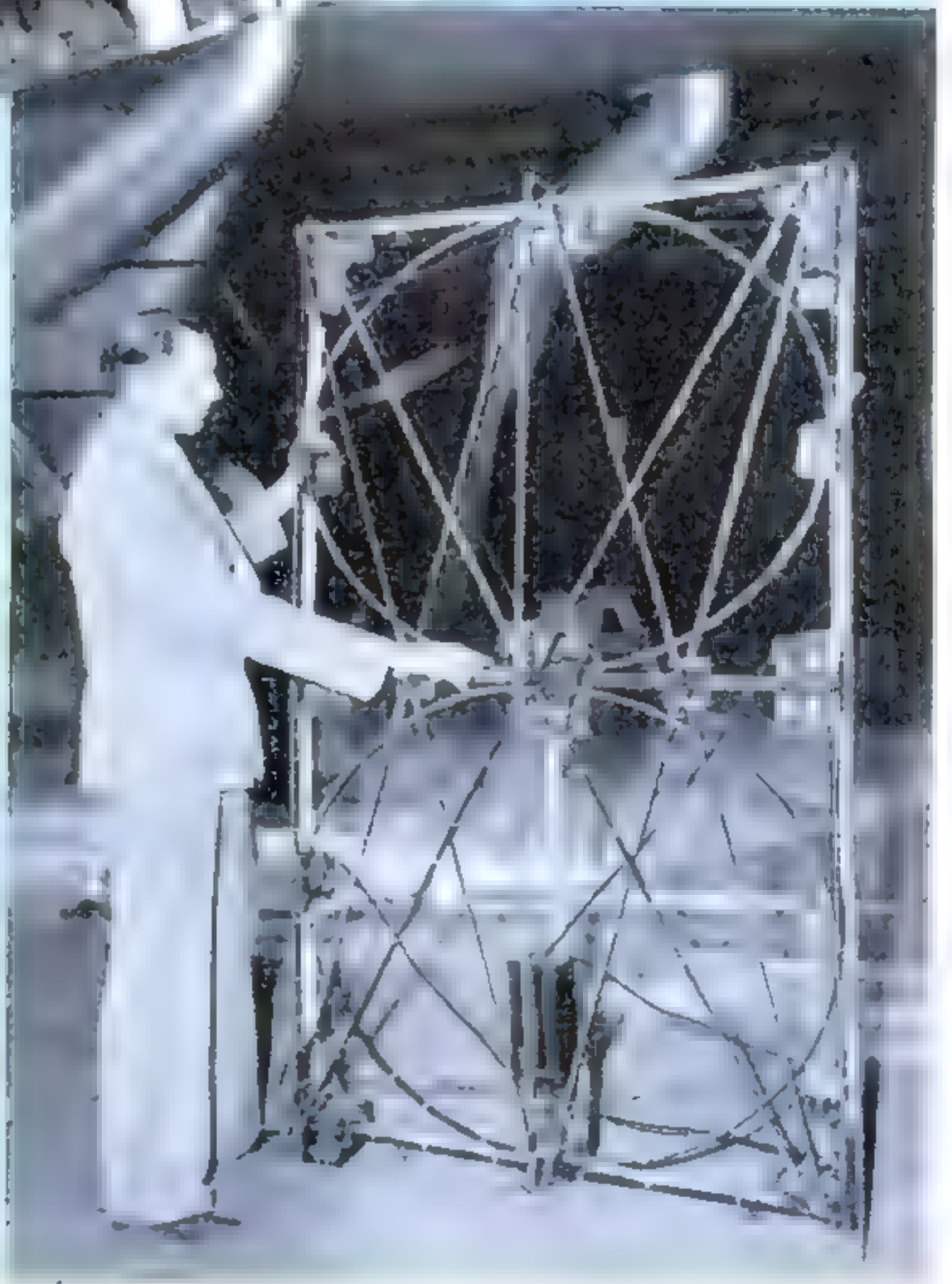


Attaching lighting units to the side of the small airship for a night cruise. The ten frames fasten on like window screens

One of the lighting units is seen at the right. Its maze of crisscross and curving neon tubes can form any letter or numeral



Power for the lights is supplied by this tiny generator, which is connected to one of the motors that run the tiny dirigible



Flying Electric Signs

BILLBOARD blimps, carrying flashing neon signs through the night sky above big cities, form the latest innovation in spectacular advertising. The aerial electric signs, developed and patented by Goodyear Rubber Co. experts, spell out sentences a word at a time like many of the big displays on New York's Great White Way.

Ten lighting units, each approximately six feet high and four feet wide and formed of a maze of curving and zigzag neon tubes, are attached to the side of the semirigid dirigible before the take-off. An ingenious hooking arrangement permits them to be

attached or removed in a few minutes. Each unit is capable of producing any number or any letter of the alphabet.

During the flight, an automatic mechanism makes the proper contacts to spell out the desired words on the side of the blimp. Perforated tape, similar to that used in player pianos, runs through the switching mechanism, the perforations tripping mechanical fingers to make the electrical connections. The sign remains the same until the next series of perforations is encountered, flashing on another series of letters.

The tape, prepared in a special machine



Section of the switching tape that spells out "POPULAR SCIENCE" as at the right



Cruising over the city, the blimp flashes its advertising message, a word at a time



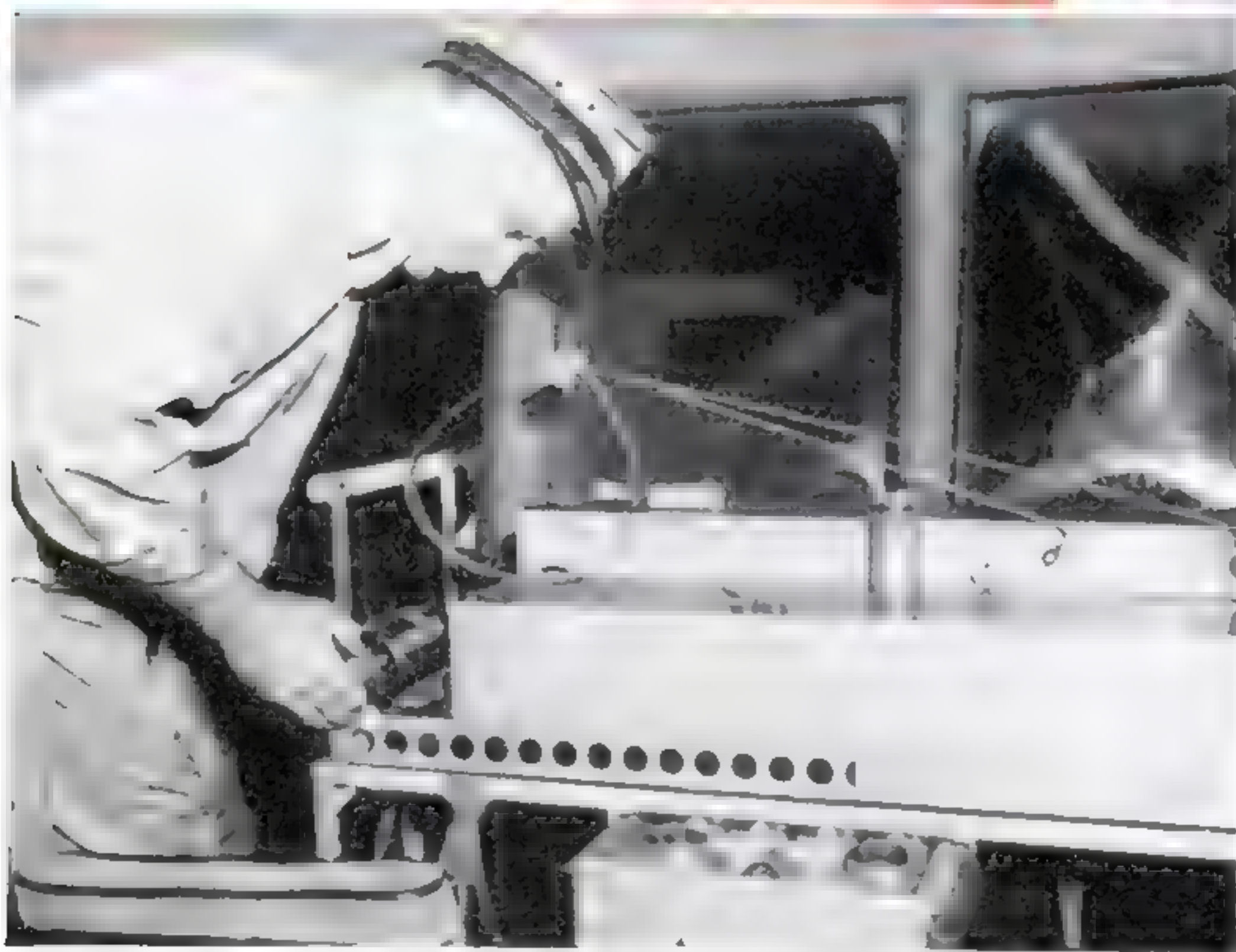
After one word has been lighted for a sufficient time, the next shines out in turn

Outlined against a night sky, the odd flying billboard is visible to millions in the crowded city

When new "copy" is received by radio, it can be recorded on tape with this apparatus



Loops of tape for various advertising messages are stored in this handy rack



Switching mechanism in which perforated tape makes contacts to spell words

resembling a typewriter, is cemented into an endless loop when the same series of words are to be repeated over and over again. Usually, from fifteen to thirty dif-

ferent tapes are taken aloft for use during a four-hour advertising flight. Once, a series of signs that required an hour and a half to display were incorporated in a single roll.

Throughout each flight, the men in the control room of the flying billboard keep in touch with the base hangar. If it is desired to run a new series of words, a tape

can be prepared quickly by means of a small punching machine carried in the airship.

Besides flashing out the words of adver-

tising slogans and the names of products, the new service is being used to announce special news events, to give weather reports and to aid various civic activities. And in wartime, it may be used to warn citizens.



Tapes are usually prepared in advance at the ground headquarters on a machine operated like a typewriter

Weather maps are studied carefully before a flight, as at left, to make sure that wind and other conditions will be favorable



From this radio station at headquarters, orders can be sent for new "ads" while the blimp is aloft



Dr. Smith trains a microscope on a poisonous insect

Finds Poisonous Insects Are Often Overrated

MAKING detailed studies of poisonous insects is the job of Dr. Ralph H. Smith, professor of entomology at the University of California at Los Angeles. Many of the insects whose bite most people consider deadly are actually harmless, Smith has determined. The sting of a common bee, he claims, is potentially more dangerous than the bite of a scorpion. Also overrated, he says, is the tarantula, whose fangs lead many people to believe that its bite is always fatal. Even the lethal powers of the black-widow spider, Smith says, are exaggerated.



Air is blown into a mouthpiece at butt end of gun

Toy Gun Blows Bubbles

SOAP BUBBLES are the projectiles fired from a toy gun placed on the market not long ago. A mouthpiece located at the butt end of the barrel has two separate holes for blowing small or large bubbles. Rapid blasts of air directed through both holes in the mouthpiece will produce a cloud of minute bubbles. To "load" the bubble gun, the muzzle end is simply dipped in a pan or dish of soapy water.

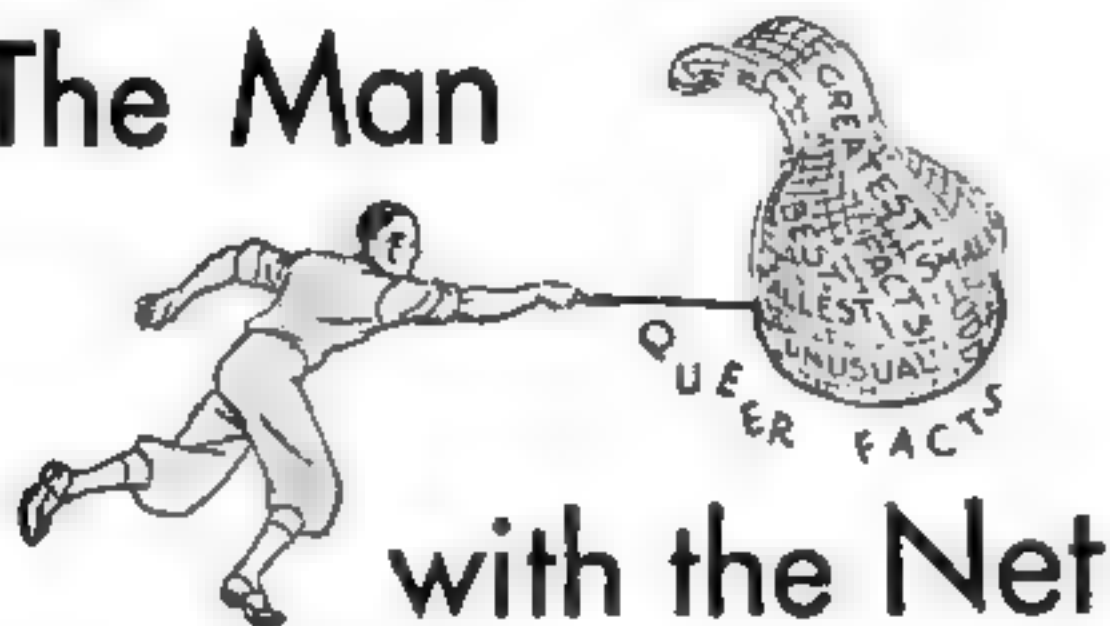


Children sampling the "toothsome" morsels of which the house was built

House Is Made of Foods for Healthy Teeth

NICKNAMED the "vitamin house," a model dwelling displayed at a recent convention of the American Dental Association was constructed of foodstuffs containing all the vitamins necessary to the development and preservation of sound, healthy teeth. The house and its furniture were made of cereals, cookies, fruit, and nuts; the foliage and shrubbery surrounding the building consisted of spinach and fruit.

The Man



with the Net

GOLD-PLATED ROSEBUDS and copper-plated bunches of grapes were recently displayed at an electroplating convention in New Jersey.

LONGEST MUSCLE in the human body is the sartorius which runs from the hip to the knee.

THIRTY THOUSAND BEES, in a swarm, once descended on a boy riding a bicycle along a country road.

FEELS MORE LIKE
30,000,000,000



SEVENTY percent of the smoke from a pipe is steam.

TWENTY THOUSAND four-leaf clovers have been collected by Mrs. Florence M. Smith, of Detroit, Mich.

UNMOLESTED, birds would increase from four to five times as fast as animals.

MOTORISTS in Cheyenne, Wyo., can be fined \$100 for leaving their parked cars unlocked.

AVERAGE Americans consume about one ton of food a year apiece.



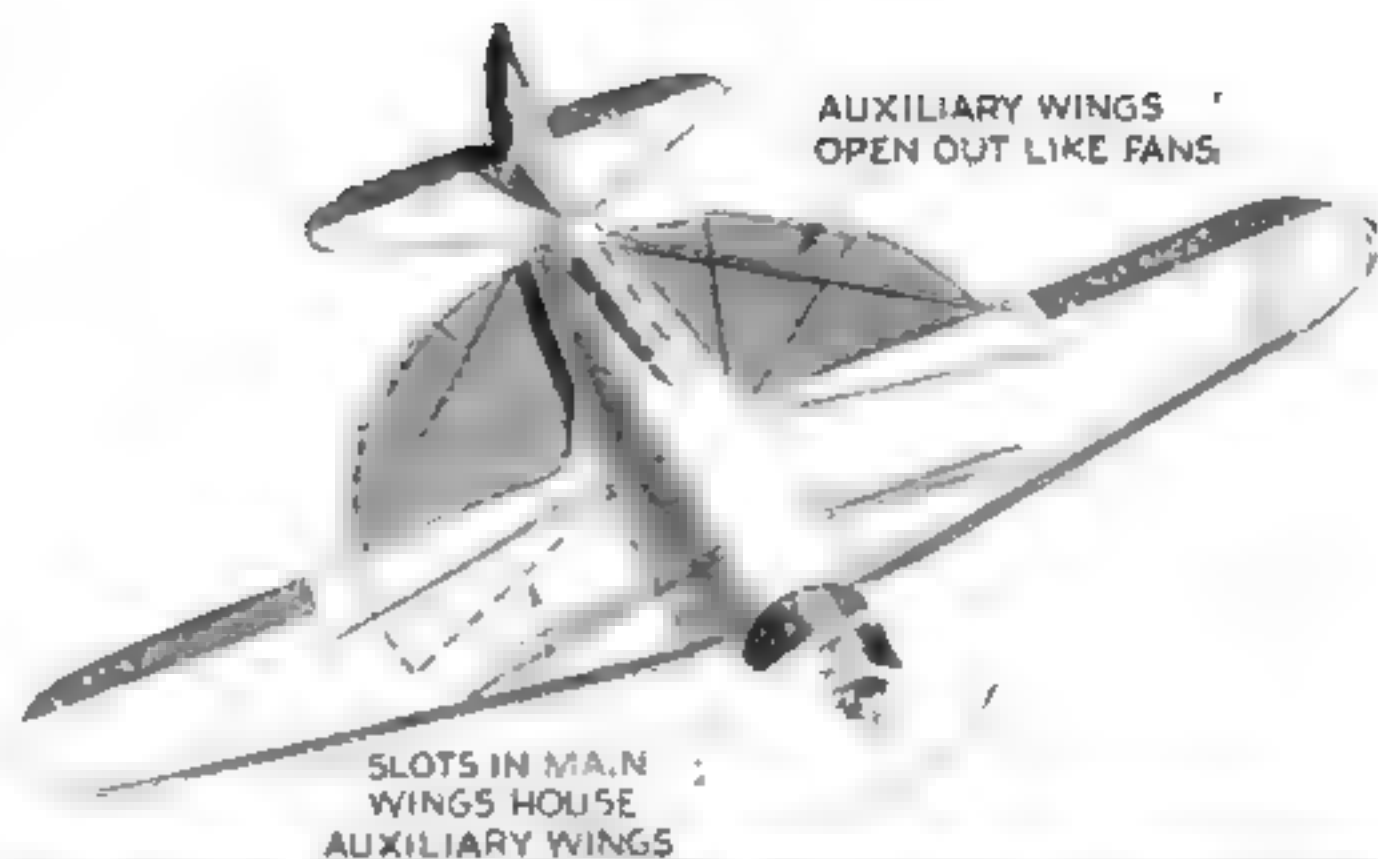
G'WAH. I DON'T
WEIGH A POUND
MORE THAN
LAST YEAR!

PEARLS are sometimes formed around tiny fish that enter oyster shells in the tropics.

WINETASTERS sometimes become so expert they can tell whether the grapes from which a beverage was made grew on the sunny or the shady side of a hill.

MORE than fifty percent of the world's population lives on five percent of the earth's surface.

AND THAT'S WHY
WE HAVE WARS!



How fan-shaped auxiliary wings would be extended for take-offs and landings at moderate speeds

Telescoping Wings Allow Planes To Land Slowly

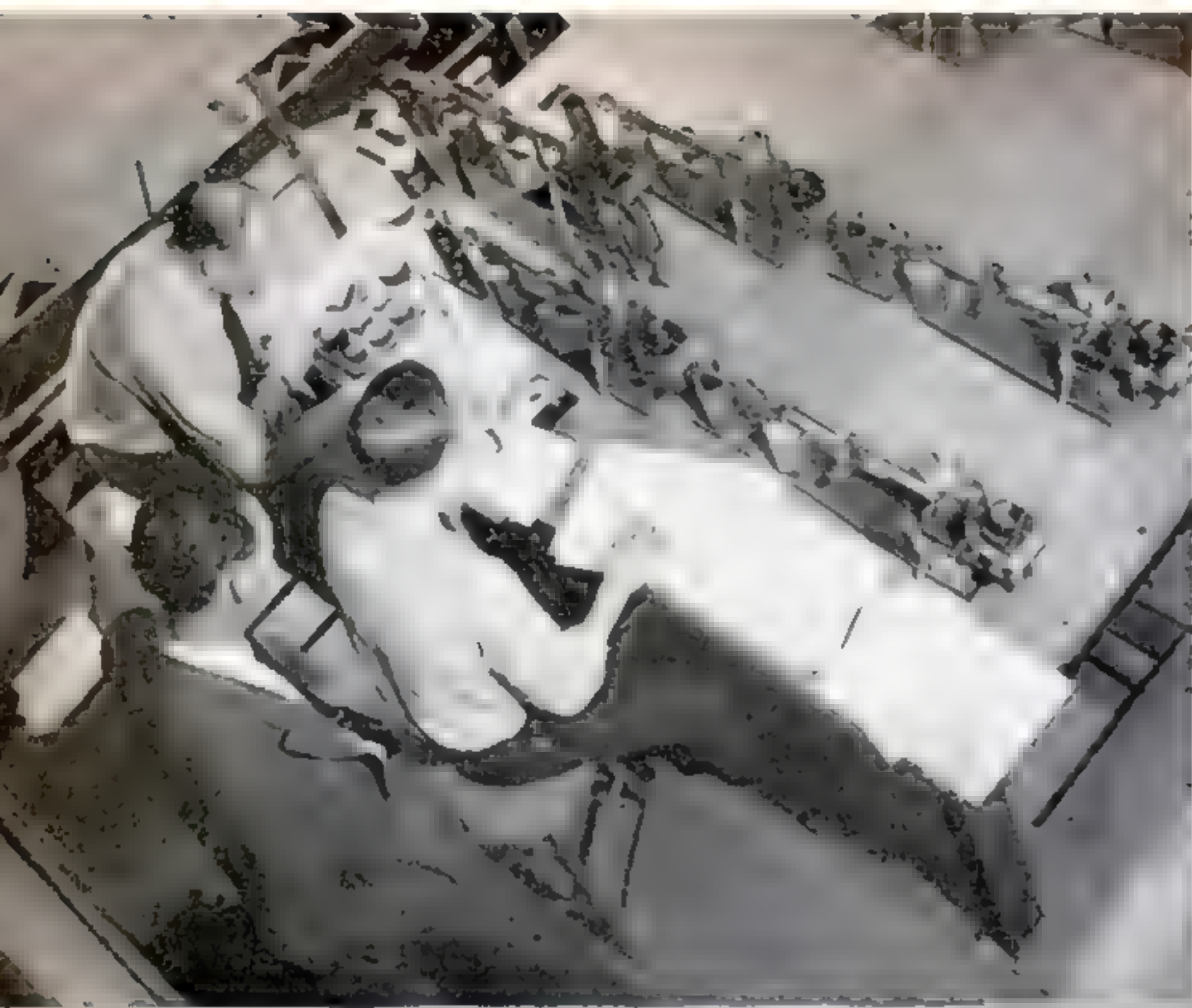
TO MAKE it possible for high-speed airplanes to take off and land at reasonable and safe speeds, Michael Gliwa, of Chicago, Ill., has developed a novel system of telescoping auxiliary plane wings. Spreading outward, platelike sections slide from a hollow storage slot in the trailing edge of the plane's fixed wing, as illustrated above, to increase the effective wing area of the plane.

Tool Shapes Brake Lining To Eliminate Car Noise

SQUEAKS, chatter, and other noises caused by the improper fitting of an automobile brake shoe and lining into the brake drum are said to be eliminated by a new tool. After the lining has been attached to the shoe, both are shaped to the correct arc by a gradual bending process with the tool.



Shaping a brake lining and shoe with the new tool



Students on the "balance platform" at left record results of tests made on an experimental gyro rotor designed by one of them, and hung by wires in the tunnel seen below

Gyroplane Design Is College Course

KEEPING pace with a revived international interest in helicopters, autogiros, and other types of rotating-wing aircraft (P.S.M., Feb. '39, p. 124), the College of Engineering of New York University, in New York City, has recently established a course in gyroplane design that is said to be the first of its kind in the world. Under the direction of Dr. Alexander Klemin, aeronautical engineer and consultant, graduate students of general aeronautics study the special theories of aircraft that substitute whirling blades for stationary wings, and test these theories by practical experiments in laboratories, class-

rooms, and in the school's nine-foot experimental wind tunnel. The photographs on this page show some of the varied activities of the gyroplane students, including classroom "skull practice" in the illustration below, and work in and atop the wind tunnel in the two photographs above.

The students are encouraged to conduct independent research and develop their own design theories. Laboratory work will also be conducted in close coöperation with leading American airplane and autogiro manufacturers, in an intensive effort to advance gyroplane knowledge.

Dr. Alexander Klemin delivers a blackboard talk to pupils in the world's first school of gyroplane design



Bananas Thrive in Vertical Greenhouse

AS AN interesting hobby and as a means of attracting customers to his store, John F. Pitts, Fayetteville, Tenn., grocer, raises his own crop of bananas in a curious vertical greenhouse. Pitts planted a twelve-inch sprout of the tropical tree in 1936, kept it in his store during the winter, and transferred it to open ground in the spring. When fall came, he built the odd greenhouse pictured at the right to protect it from the frost. The tree is now more than twenty feet tall and has yielded its first crop, six hands of Tennessee bananas.



John F. Pitts with his Tennessee bananas, grown in the odd greenhouse shown above



Once thrown away, these peach-cannery by-products now are used as fuel

Truckman Finds "Gold Mine" in Peach-Pit Fuel

NINE years ago, R. Hensley, of San Leandro, Calif., was making a bare living trucking peach pits from a cannery and dumping them into San Francisco Bay. But as the result of a bright idea he had, he now makes a profitable income selling the pits as fuel. Sun-dried in an open field, the pits are said to give as much heat and to last as long as hard coal. The low-cost fuel is used in home furnaces, stoves, and grates.

Fish Furnish Leather for Making Shoes

FISH SKINS, specially dried and tanned, are now being used in Italy for the manufacture of shoes. Six or seven skins pressed tightly together into one thickness are shaped into shoe uppers that are said to be strong and serviceable. Although the fish-skin material is made especially for shoes, it is also used for making machine belts and brake linings.



Fish-skin shoes—and some of the raw material

Gas Keeps Berries Fresh

FRESHLY picked strawberries and raspberries placed in a cool, gas-tight room and treated with a thirty-five to forty-percent concentration of carbon dioxide for from four to seven hours are said to keep fresh for forty-eight or more hours longer than berries not given this treatment.

Dolls Have Flexible Limbs

FLEXIBLE arms and legs that can be twisted in any direction are the outstanding feature of a new doll to be on the market before Christmas. The limbs of the doll are made of braided wire so that children can twist or pull them to make the doll assume any attitude desired. Two of the new playthings are seen at the right, posed to represent a step in a dance routine.

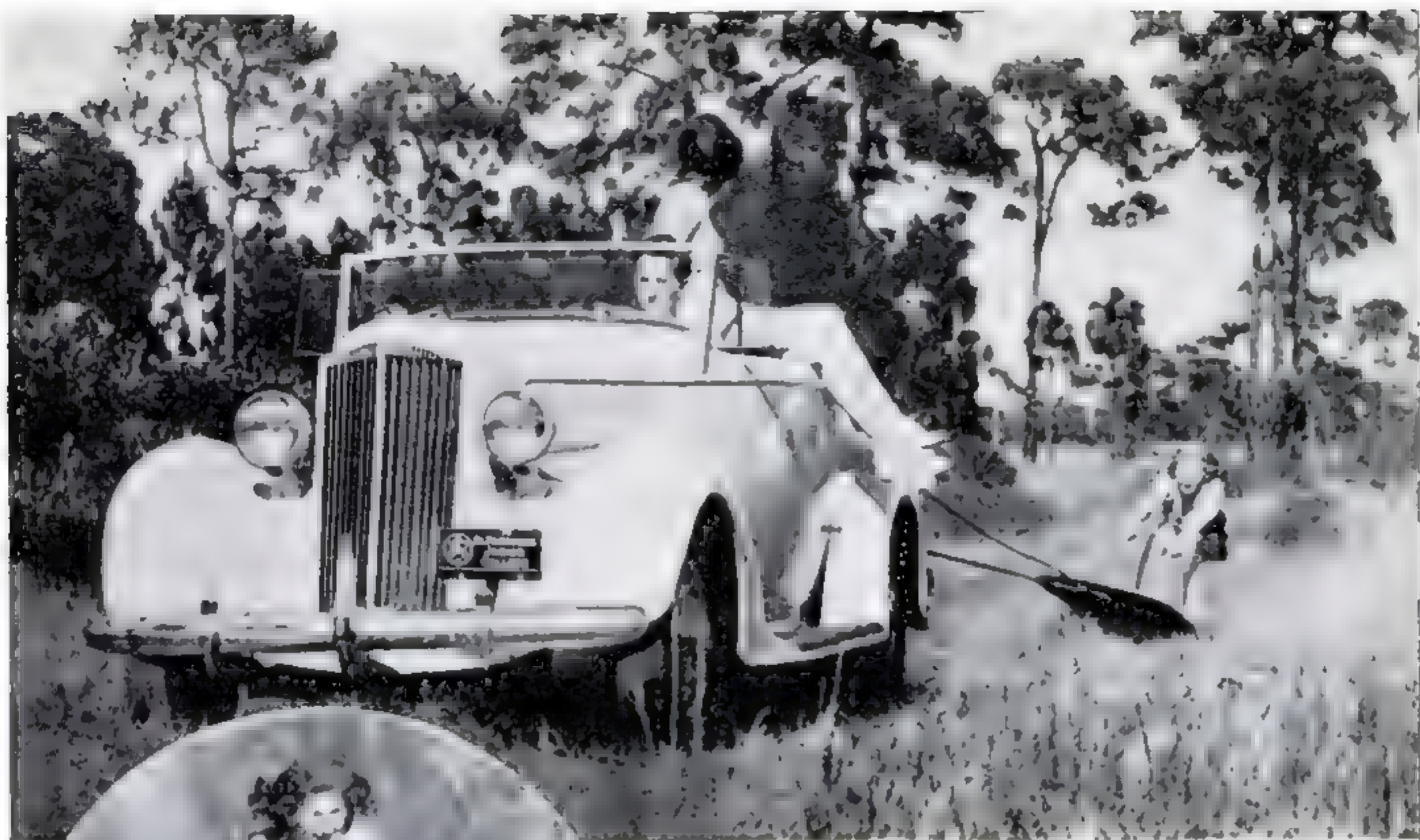


Four-Bladed Propeller Tested for Planes

BELIEVED by aeronautical experts to presage a new trend in propeller design for all types of airplanes, a four-bladed propeller, shown in the photograph above, is now being tested on a U.S. Army pursuit plane. With the new four-part prop, engineers state, engine power may be increased from its present maximum without increasing the length of propeller blades. For, if two or three-bladed propellers were used with more powerful engines, it is explained, blades would have to be longer, thereby necessitating heavier landing gear to afford the required clearance with the ground.



These dolls are so limber they can do modern dances



Towed by a speeding car, this daring girl is in for a nasty spill if she doesn't watch out

Dry-Land "Aquaplaning" Is Thrilling New Sport

"AQUAPLANING" on dry land, towed by a speeding car, makes a risky but thrilling sport introduced by junior college students at St. Petersburg, Fla. By shifting his weight, a skillful rider can swing the board in wide arcs from side to side. He must lean far backward to keep its front in the air, since the board, unlike those used in the water, has a constant tendency to flatten out—and collision with a half-buried rock would mean a none-too-gentle spill.

Polish Plane Packs Guns in Its Pants

WAR PLANES now even carry guns in their "pants." The illustration at right, of a new Polish fighting craft, shows how a machine gun is attached to the streamline fairing of the undercarriage. Like other guns installed in the plane, it is fired by remote control from the cockpit, as the pilot points his machine head-on at the target. In contrast, designers of American fighting planes prefer to mount the guns elsewhere, so that the landing gear may be retracted in flight for less wind resistance and greater speed.



Machine gun on plane's undercarriage. It is fired by remote control

Old Powder Horns

COLLECTING powder and shot containers—dating from before the time of Columbus to the last powder flask patented in 1891—is the unique avocation of C. Stanley Jacob, of Plainfield, N. J.

A powder horn of the Revolutionary War, a family heirloom given him thirty years ago by his grandmother, started Jacob on his strange hobby. Since then, he has begged or bought every ammunition container that he could find—including powder horns and flasks, shot flasks, powder kegs, canisters, and bandoleers. As a result, his attic museum now contains more than 1,200 pieces, all different; probably the largest collection of the kind in the world. In the opinion of experienced collectors, it is worth fully \$100,000!

A flask of Juan Sebastian del Cano, vice admiral of Magellan's fleet; horns of the pirate captains of Sir Henry Morgan; powder containers of African savages, Per-

sian princes, and American pioneers, are among the items in this odd collection which bring history vividly to life. Other unusual pieces include containers made from deer antlers, shin bones, hip bones, gourds, tortoise shells, lobster claws, and jade. Some of the most elaborate pieces are Turkish and Persian, made in exquisitely carved ivory, engraved brass, or wood in-



Two tricky ammunition containers. The upper one dispenses both powder and ball



C. Stanley Jacob in the attic museum that houses his remarkable collection



Elaborately carved flasks from the East

Form Unique Collection

By ROBERT E. MARTIN



The collector with some powder flasks made from bones and antlers and carved in elaborate designs

Every flask in this group was made from a different material, including tortoise shell and lobster claw

screw-driver blade at one end.

Gathering this great collection

laid with delicately tinted mother-of-pearl.

Most ammunition containers were designed to hold only either powder or shot, but Jacob has a few rare models that are divided into compartments to hold and dispense both. Some of the brass French powder flasks of the late eighteenth century have gun wrenches in the middle, and a

has required not only a small fortune in money, but a vast amount of work, patience, and strategy. Generally Jacob buys his horns, or gets them by trade. He has one horn which the owner would not sell at any price. He waited ten years. The man finally died, and Jacob bought the priceless horn at auction for a dollar!



Z. Wiggs out for a spin in his poochmobile. A one-dog-powersquirrel cage drives the vehicle

Walking the Dog Drives Poochmobile

DOG POWER drives an odd vehicle constructed by Z. Wiggs, eighty-year-old dog trainer and former railroad worker of Denton, Tex. Operating on the squirrel-cage principle, the dogmobile has a giant central wheel which is revolved as a dog walks or

runs on its inside surface. The four-legged canine engine is anchored to a central shaft by a special collar. Power is transmitted to rear drive wheels by means of a belt-and-pulley mechanism which the driver controls by a "gearshift" lever.



Ship models like this changed W. C. Leavitt's hobby into a good business

Ship Models Made His Own Ship Come In

YEARS ago, Walter C. Leavitt, of Warren, Me., used to spend part of his spare time making scale models of famous sailing ships. So accurate and so detailed were his miniature vessels, however, that he soon was in demand by maritime museums all over the world as an expert repairman for their old ship models. Then orders for new models began to pour in, and Leavitt has built more than 200 model vessels which are now displayed in museums in all corners of the globe.

Famous Cog Railway Goes Streamline



Diesel-electric train on the cog railway up Pike's Peak, Colo. Left, engine compartment with three generator units

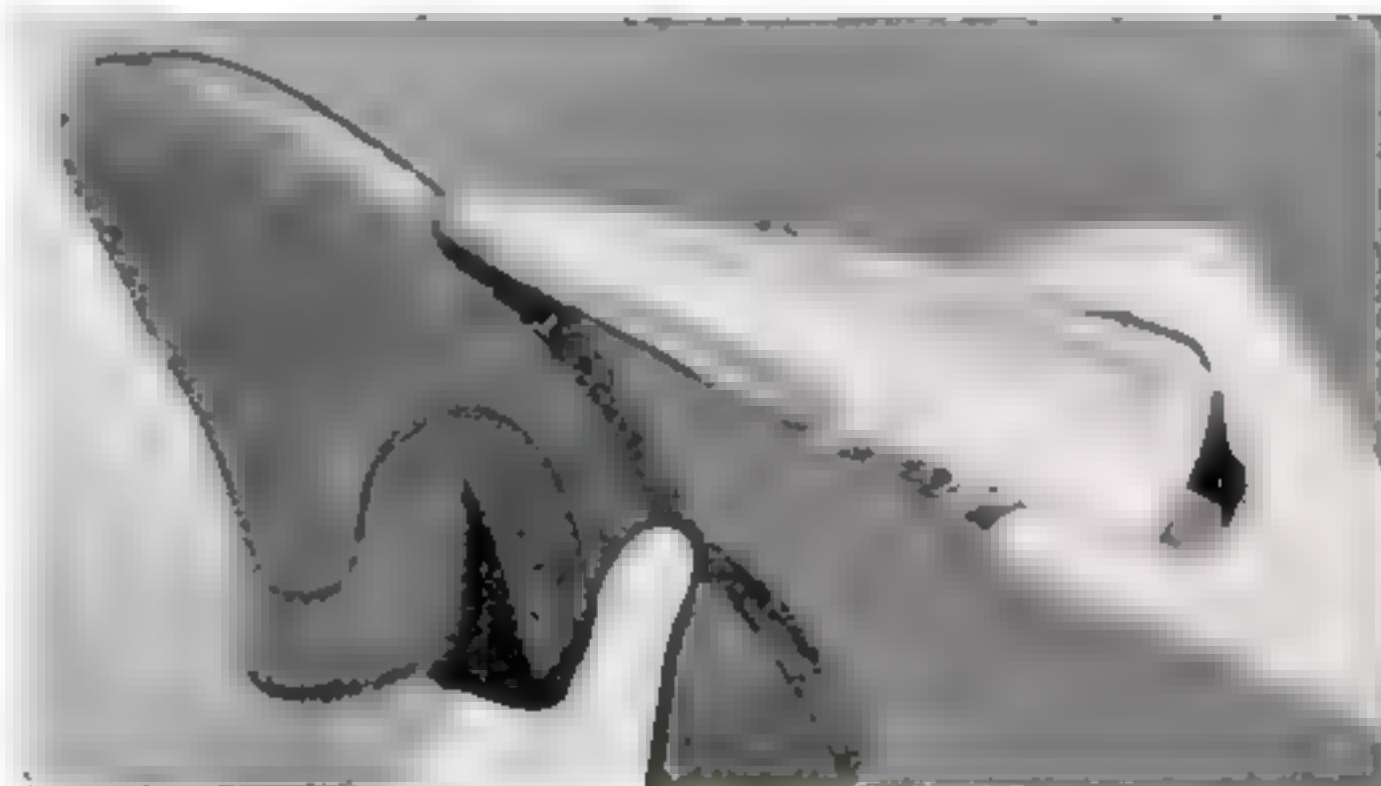
Diesel motors installed in the train's power car are said to cut running time by thirty percent, while slicing operating costs in half. Driving electric generators that supply power to motors geared to the cogs, three Diesel units are mounted in the locomotive at an angle of nine degrees from horizontal. Each acts independently, and any one motor will supply sufficient power to haul

STREAMLINE, Diesel-powered trains are now being introduced on the cog railway that hauls sight-seers to the summit of Pike's Peak, Colo., 14,109 feet above sea level. Replacing steam-driven engines, the

the observation car up the twenty-five-percent grades. Coming down, the electric motors act as generators and serve as brakes, resistance units absorbing the electric current created, thereby controlling the speed.

This Powder, They Say, Keeps the Dogs Away

PRACTICALLY odorless to humans, a powder now available is extremely offensive to canine nostrils. When the powder is sprinkled on sofas, chairs, or personal belongings such as shoes or slippers, dogs will not go near the items. And when dusted onto the threshold of a room, it is claimed, the powder will keep dogs from entering.



Pups won't chew slippers treated with this powder

Latest Aids

Three-Compartment Tank Simplifies Developing

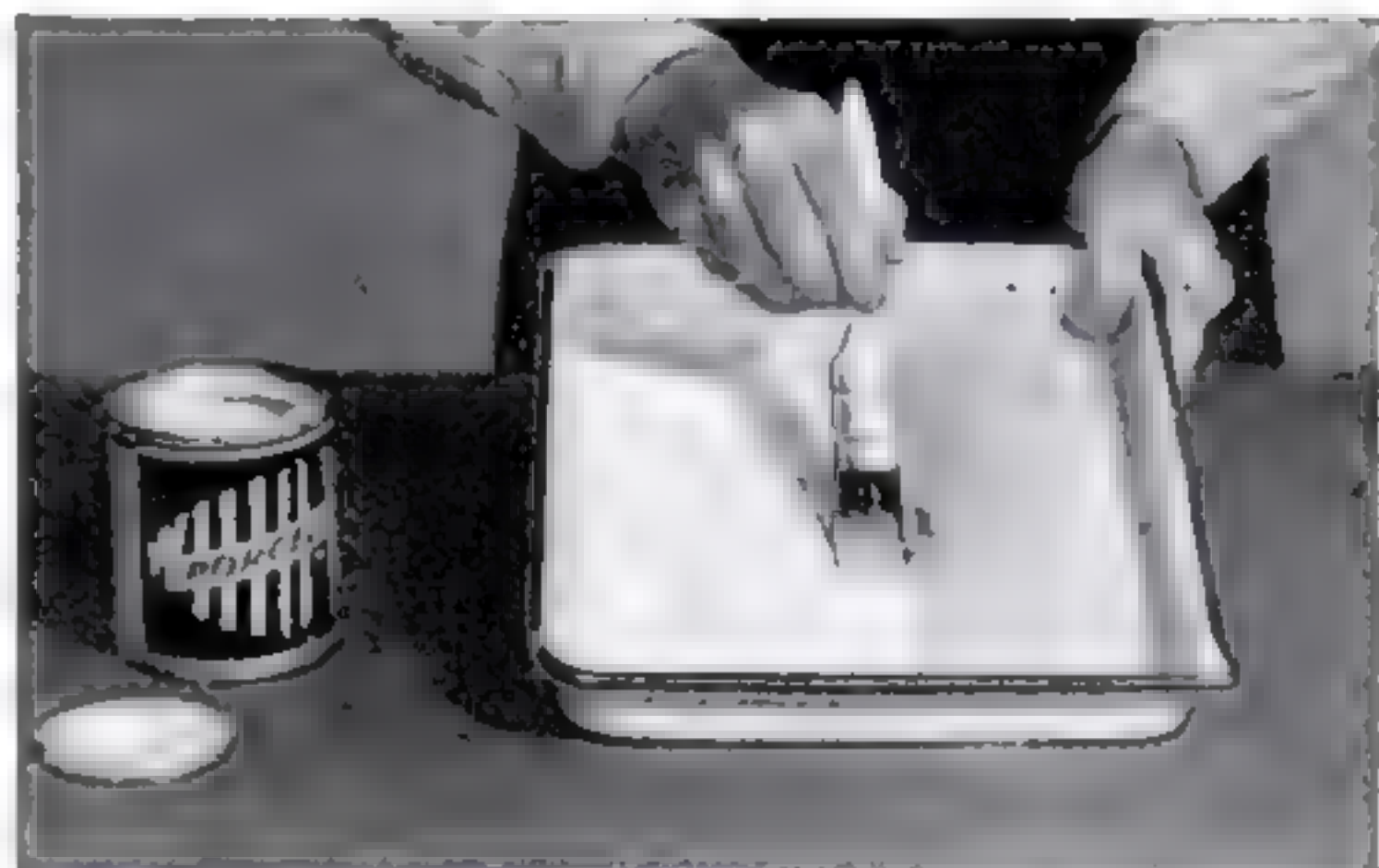
THREE compartments in a single developing tank just introduced are said to simplify developing operations in the amateur darkroom. Each compartment has its own light-tight cover and a drain plug. The adjustable film rack takes either film pack or cut film up to four by five-inch size. The compartments are filled with developer, stop-bath, and hypo before use. The rack of films is then immersed in the liquids in the proper order for the required periods, without the need of draining or refilling. A special slow-drain plug is provided to convert the stop-bath compartment into an efficient washing compartment by simply inserting it in place of the regular plug.

There's no draining and filling between operations with this three-compartment film tank



Audible Darkroom Timer

EXACT timing of any of a number of photographic operations necessarily carried out in absolute darkness is possible with a novel "audible timer" in which a hammer strikes off the seconds with taps that can be easily heard. Operating on alternating house current, the device has a constant-speed motor which is controlled by a handy switch that is easy to find in the dark.



Chemical-Resistant Paint

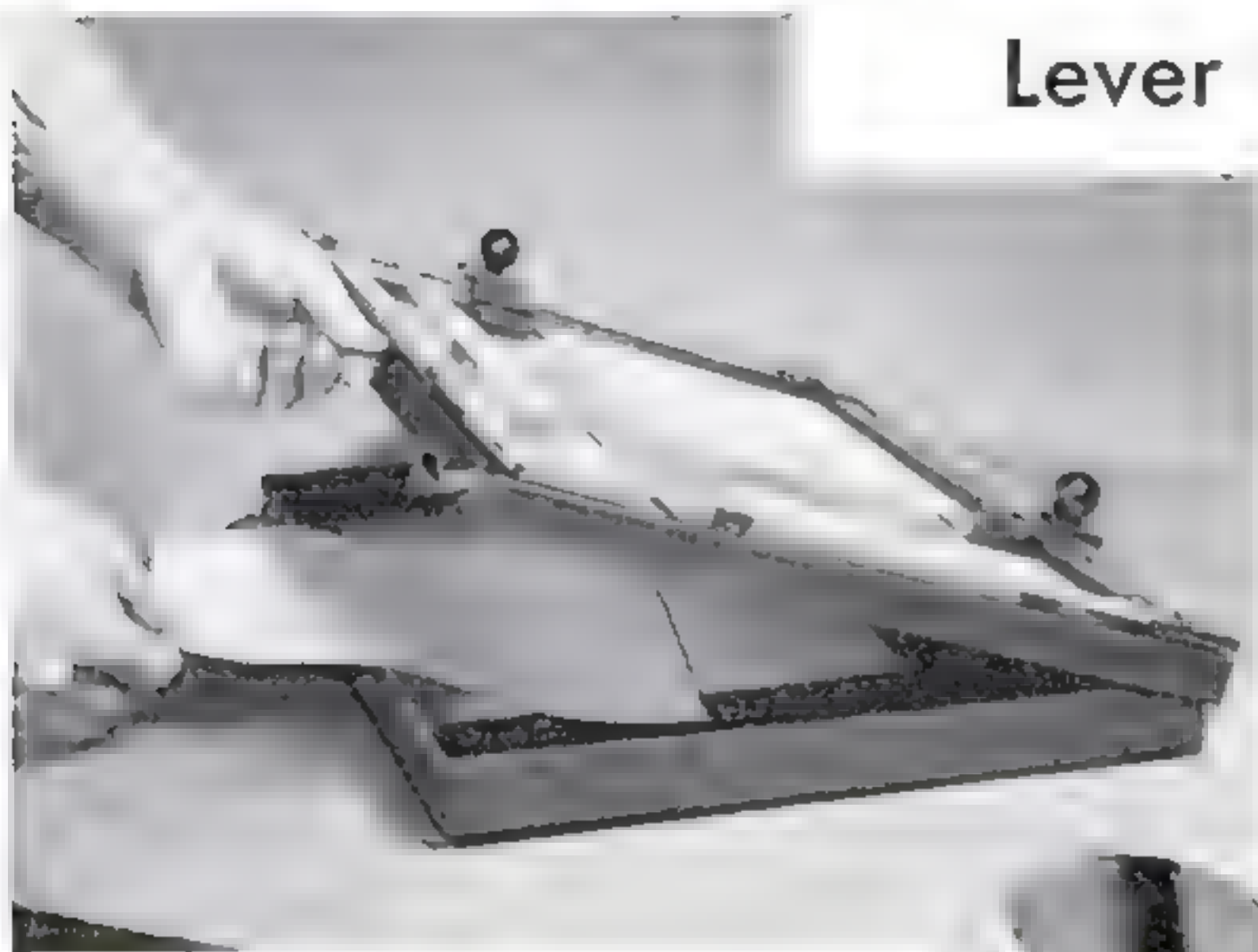
RETOUCHING of other things than pictures is sometimes a necessity for amateur photographers. To satisfy this need, a new "enamel-base" paint is now marketed for touching up trays, sinks, and other porcelain or enamel-finished articles that occasionally chip or become discolored from use. The paint is said to be resistant to both acids and alkalies, and to all the chemicals commonly used in photography.



Note the accessible switch on top

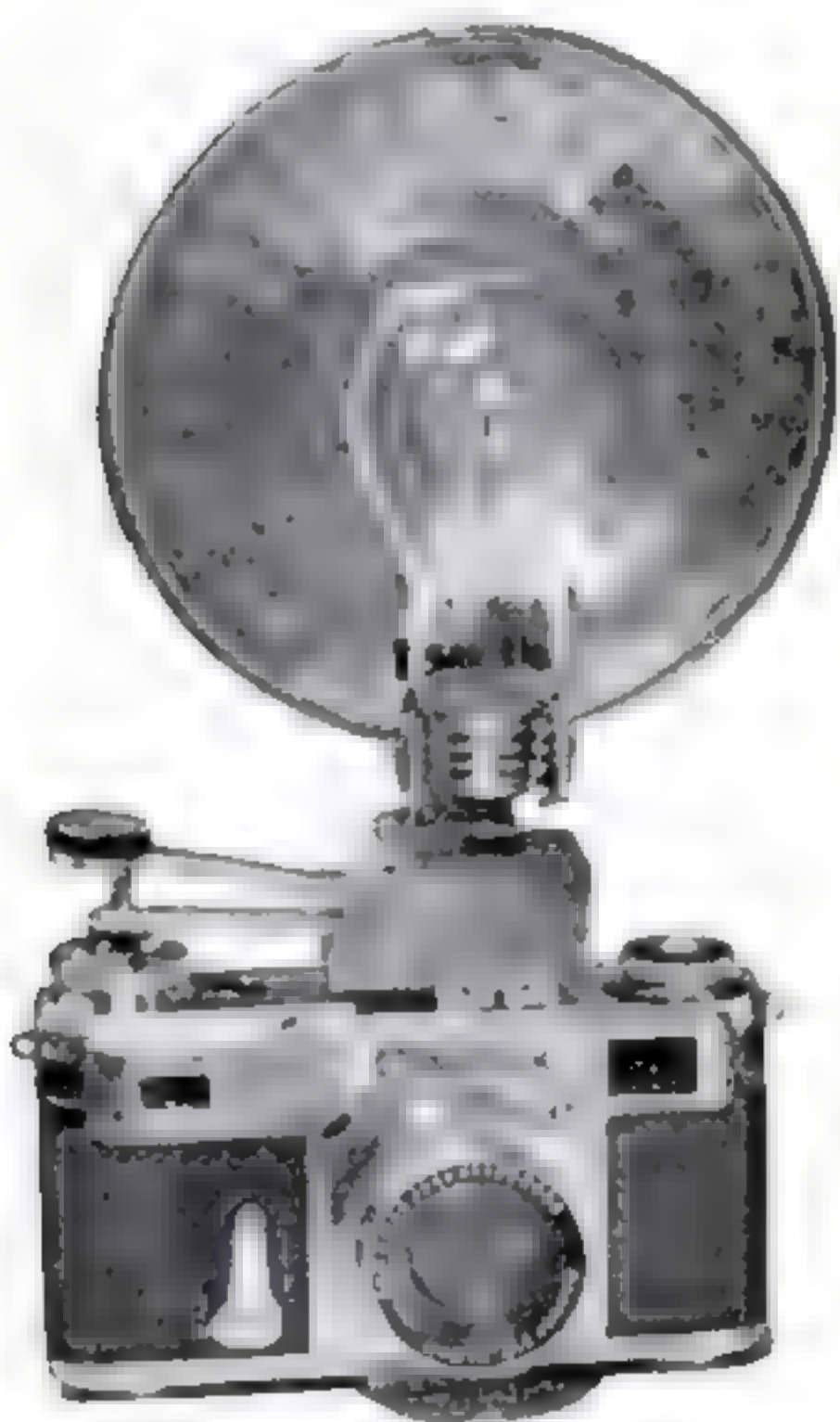
for Photography Fans

Lever on Easel Adjusts Margin



This easel stores printing paper and makes fixing of print margins easy

SIMPLY moving a lever on the side of the new enlarging easel pictured in use at the left sets any desired margin up to two inches on the finished print. A calibrated scale facilitates setting the lever at the proper point. Additional margin spacers are provided on the outside of the device. Another feature of the easel is a light-tight compartment underneath the focusing board itself, where the sensitized enlarging papers can be stored safely, yet be literally at the user's finger tips when they are needed. Of simple design, the device is sturdily built. The circular inset shows a close-up of the lever which is operated by pressing it toward the easel or away from it, its legible figures indicating the setting at a glance.

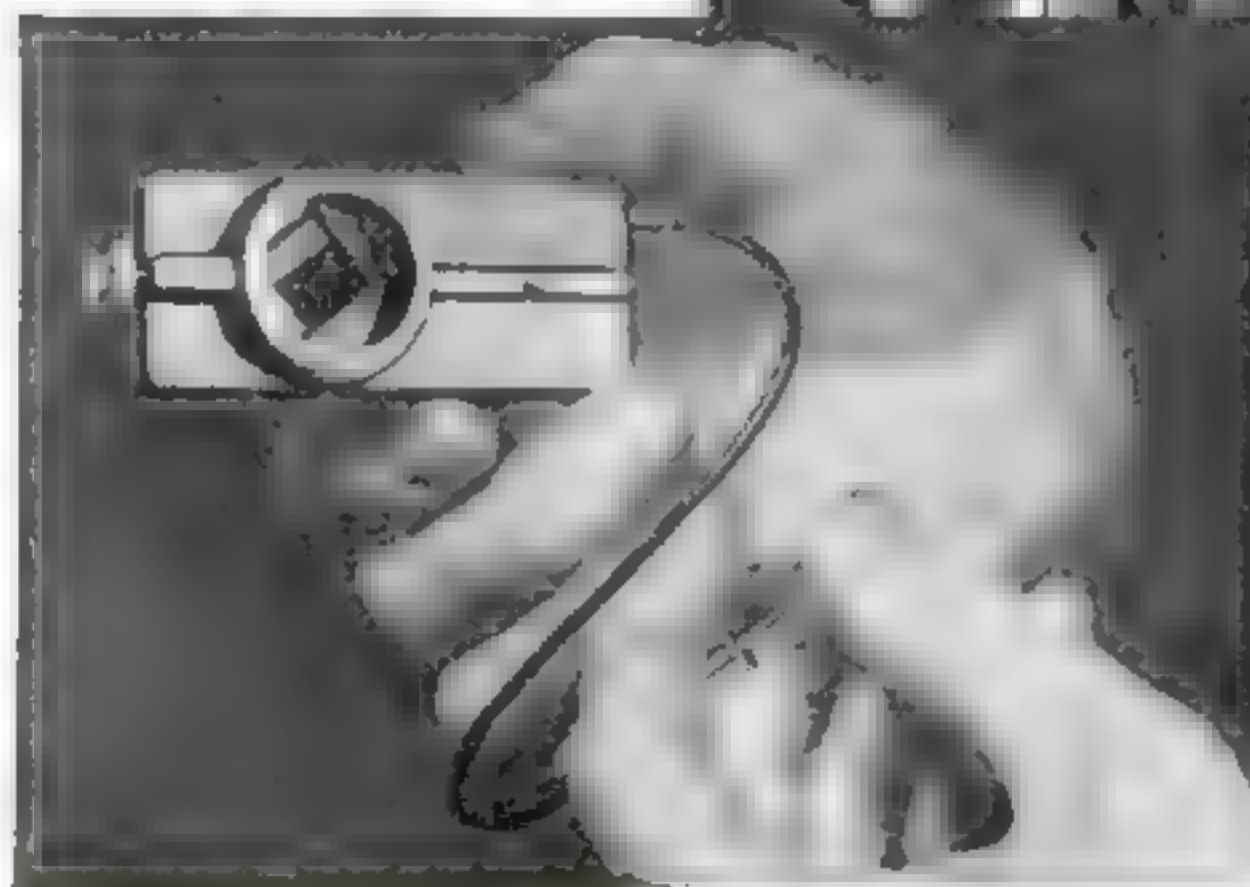


Flash Gun Fits in Range-Finder Slot

DESIGNED to fit the built-in sockets for range finders with which several makes of miniature cameras are equipped, a compact new automatic flash gun now available can be slipped quickly on or off a camera. Synchronized with the shutter, it is effective at shutter speeds of from 1/200 to 1/1,200 of a second.

Shutter Makes Oblong Fade-Outs

ATTACHED to the lens of any eight or sixteen-millimeter movie camera, the cable-release-operated device pictured at the right and below permits amateurs to make gradual "fades" at the ends of their movie shots. Its special design keeps the picture oblong in shape until the very end, a feature often lacking in fade-outs.

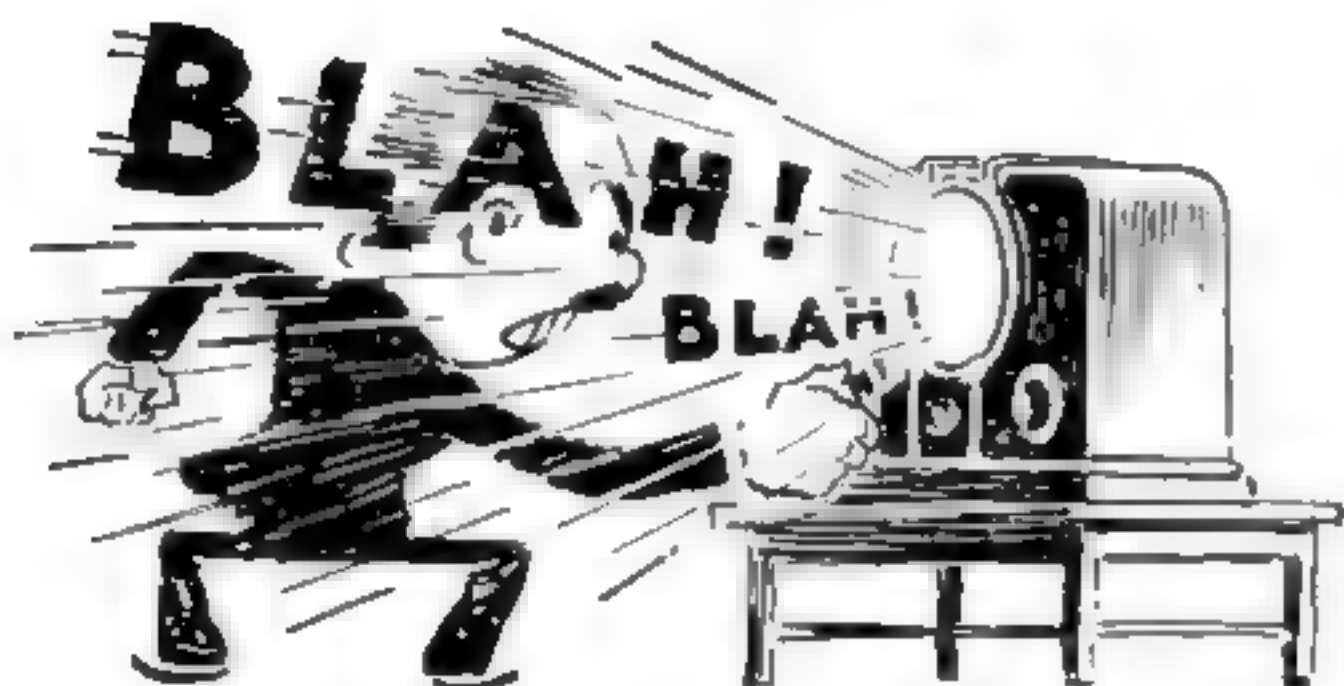


Pressing the cable release gradually closes the oblong opening so that a fade-out movie is produced. The fading scene retains its oblong shape to the end

POPULAR SCIENCE

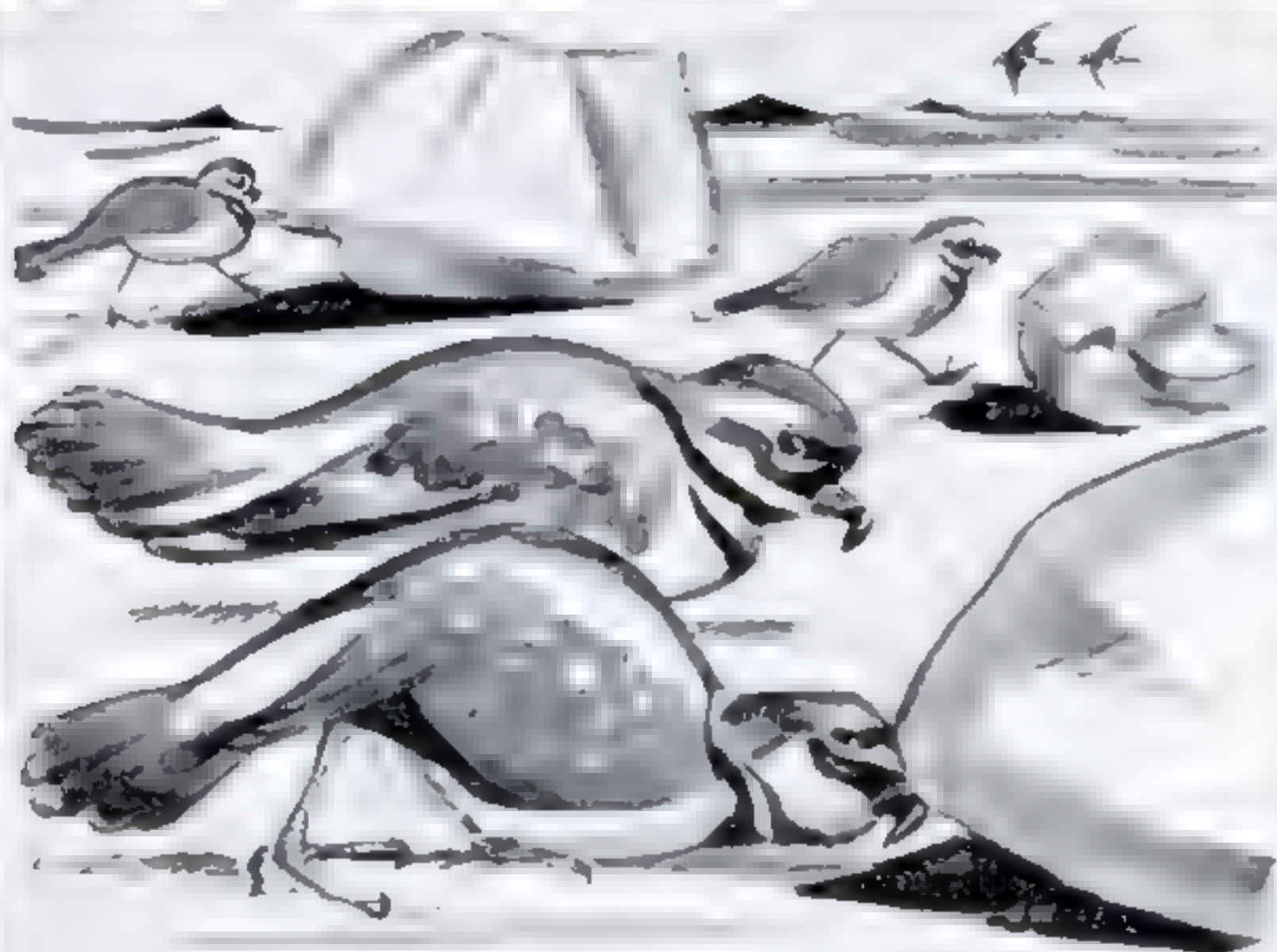
Question Bee

Counting five points for each poser you get right, you should be able to get eighty—that is, if you want to call yourself good. Ninety is excellent. Check your results on page 248



- 1 To tune in different stations, radio fans adjust (a) rectifiers (b) variable condensers (c) recuperators (d) airfoils.
- 2 When a rattlesnake wants to sound its rattle, it (a) snaps its teeth (b) wiggles its tail (c) shakes its head (d) sheds its skin.
- 3 A scalene triangle has (a) no sides equal (b) two sides equal (c) all sides equal.
- 4 Diapasons are (a) things you put on small babies (b) attachments to regulate the aperture of camera lenses (c) people with split personality (d) stops of an organ (e) instruments to measure inside diameters.
- 5 Even if you aren't a crossword-puzzle addict, you should know that Australia has an ostrichlike bird called the (a) auk (b) yak (c) emu (d) gnu.
- 6 Fluids that dissolve in each other, like alcohol and water, are said to be (a) viscous (b) miscible (c) volatile (d) friable.
- 7 A solid used as a lubricant is (a) sawdust (b) camphor (c) graphite (d) fuller's earth.
- 8 The middle part of an insect's body is called its (a) torso (b) fuselage (c) thorax (d) interregnum.
- 9 Abalones live in (a) shells (b) adobe huts (c) auto trailers (d) African jungles (e) rotting beams of frame houses.
- 10 An important ingredient of paint is (a) castor oil (b) palm oil (c) linseed oil (d) oil of vitriol.
- 11 The best thing to do with arable land would be to (a) raise sheep on it (b) farm it (c) drill it for oil (d) surround it with fortifications (e) flood it to form an artificial reservoir.
- 12 A plane table is (a) a type of sketching board used by surveyors (b) the landing deck of an aircraft carrier (c) a carpenter's workbench.
- 13 Malleable metals (a) melt at low temperatures (b) may be pounded into thin sheets (c) rust easily (d) are extremely brittle.
- 14 The specific gravity of a liquid is (a) the distance one drop will fall in one second (b) the ratio of its density to that of water (c) the amount of pure salt that will dissolve in 100 cubic centimeters, at twenty degrees centigrade.
- 15 Elephants (a) neigh (b) moo (c) bleat (d) trumpet (e) roar (f) hiss.
- 16 "Multiply by nine fifths, and then add thirty-two" is a handy rule for (a) determining what you should weigh at your age (b) converting temperatures from centigrade to Fahrenheit (c) finding the circumference of a circle, when you know its diameter.
- 17 If John Jones walks in his sleep, he's a (a) hypochondriac (b) dipsomaniac (c) misanthropist (d) kleptomaniac (e) somnambulist.
- 18 "Spirogyra" is the name applied to (a) a disk-shaped nebula (b) an airplane of rotating-wing or "windmill" type (c) a microscopic fresh-water plant (d) a gyroscope used to keep ships from rolling.
- 19 A smelter (a) is a small Diesel-powered fishing boat (b) extracts metal from ore (c) samples the odors of perfumes before they are put on the market.
- 20 A zoo would be a likely place to see a (a) lathe dog (b) powder monkey (c) lounge lizard (d) sea lion (e) Trojan horse (f) hydraulic ram.

Un-Natural History *By Gus Mager*

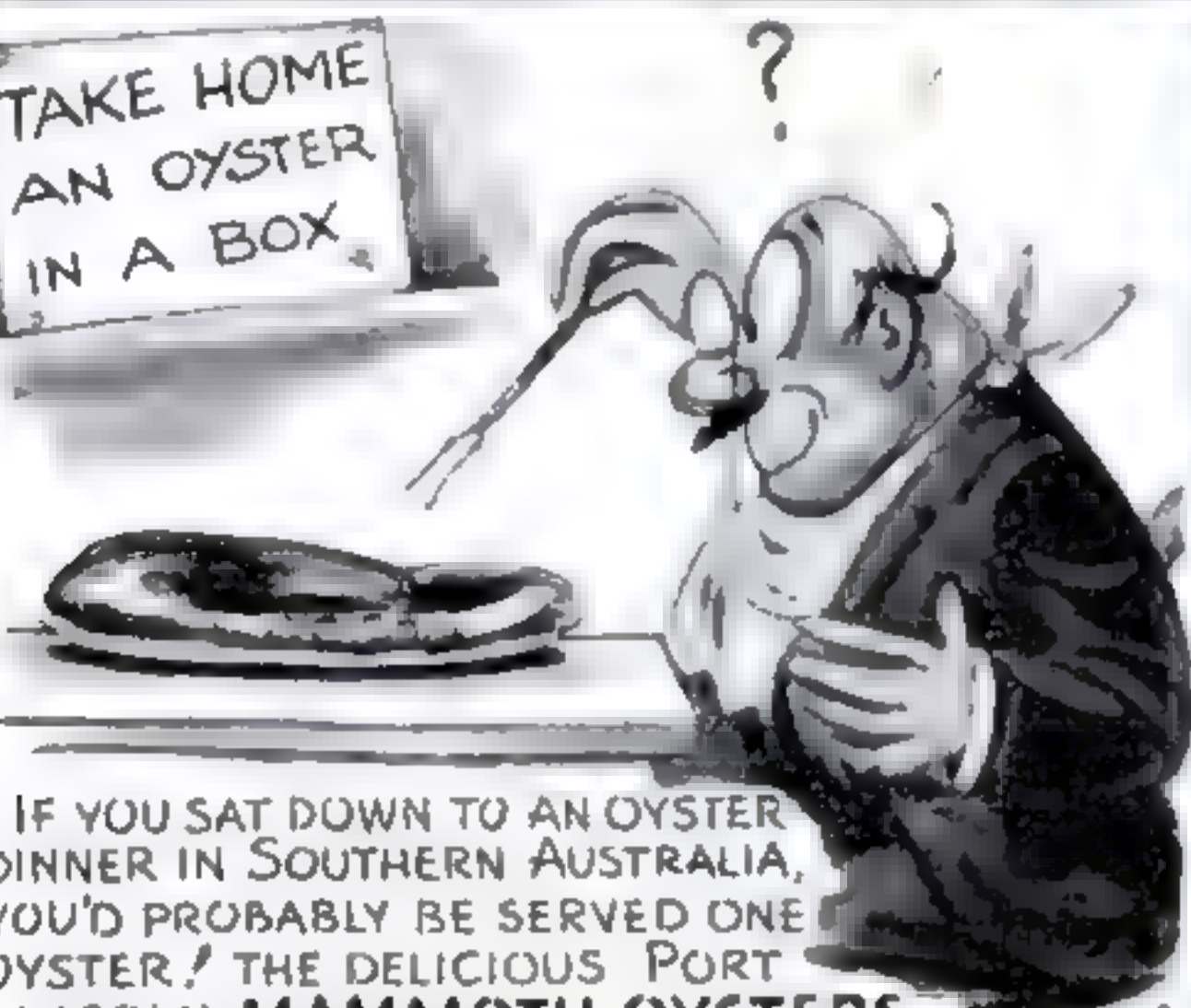


THE **WRYBILL**, OF NEW ZEALAND, HAS THE END OF ITS BEAK BENT TO THE RIGHT! IN HUNTING SHELLFISH AND INSECTS, IT RUNS AROUND STONES FROM LEFT TO RIGHT, SO IT CAN REACH AFTER ITS FOOD WITH ITS RIGHT-HANDED TOOL!

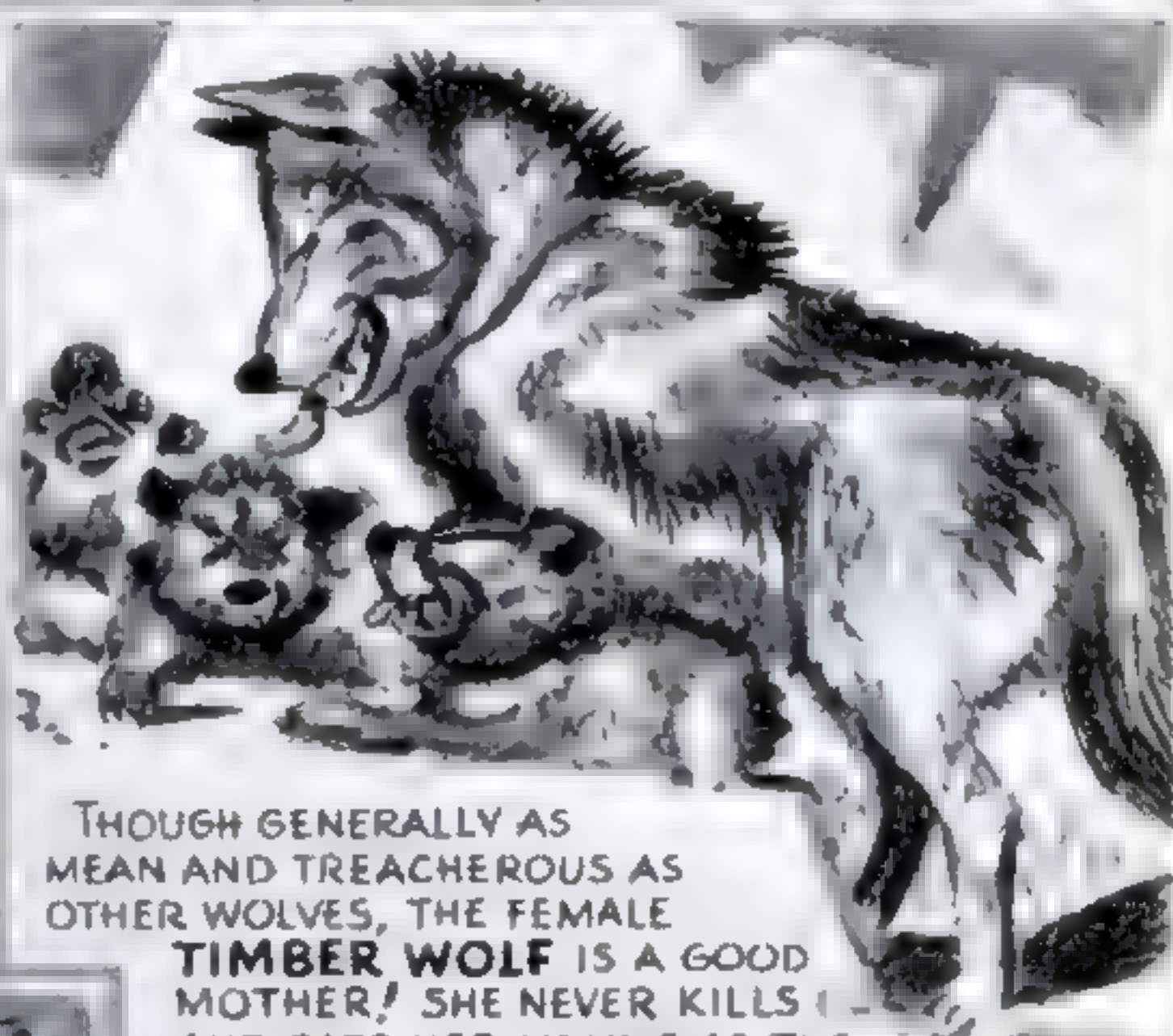
TO CRASH THE GATE OF A BEEHIVE, THE **DEATH'S-HEAD SPHINX MOTH** IMITATES THE CALL OF THE QUEEN BEE! ONCE INSIDE, IT LAYS EGGS THAT HATCH INTO PARASITE CATERPILLARS!



TAKE HOME
AN OYSTER
IN A BOX



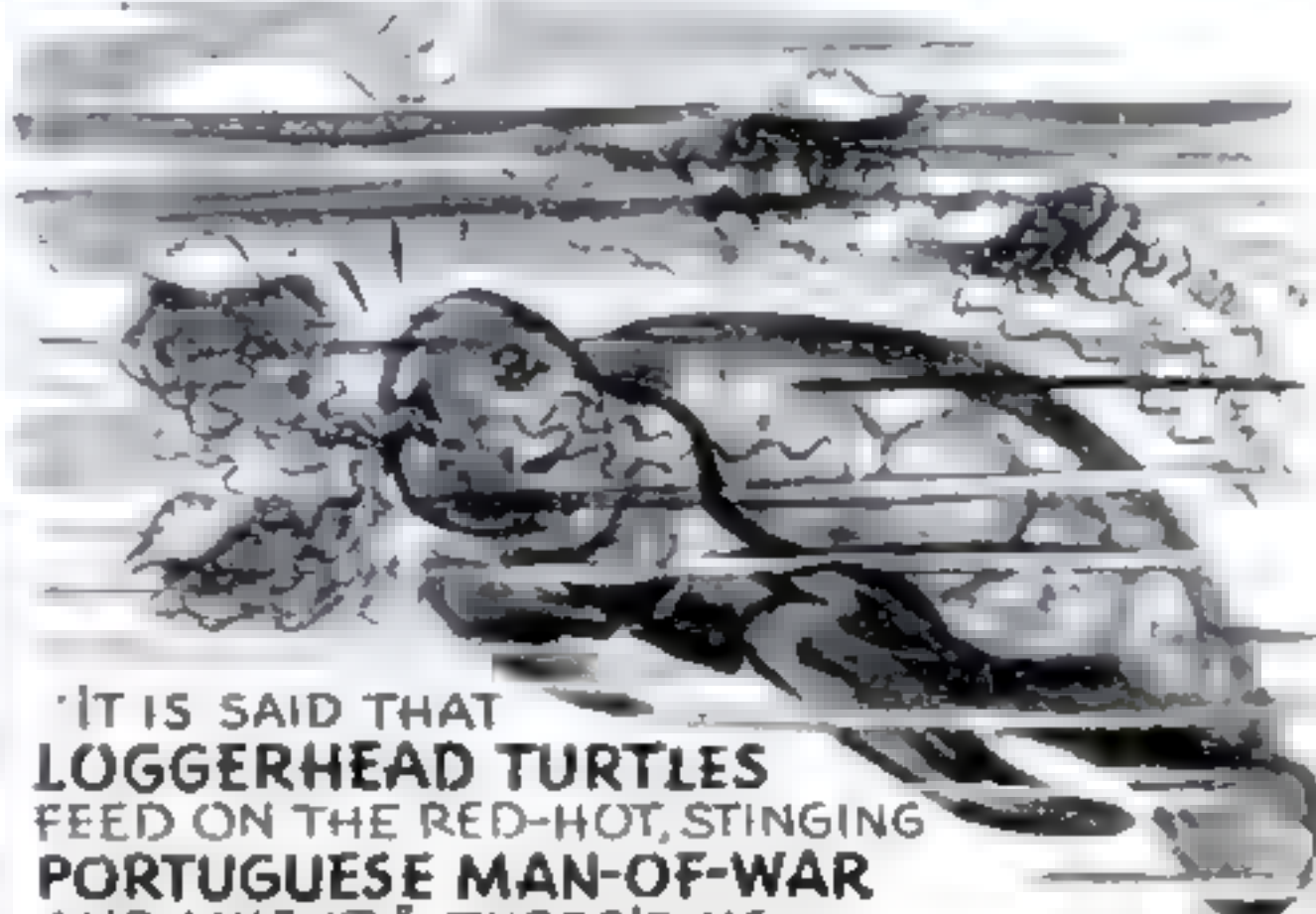
IF YOU SAT DOWN TO AN OYSTER DINNER IN SOUTHERN AUSTRALIA, YOU'D PROBABLY BE SERVED ONE OYSTER! THE DELICIOUS PORT LINCOLN **MAMMOTH OYSTERS** ARE OFTEN MORE THAN A FOOT ACROSS! —



THOUGH GENERALLY AS MEAN AND TREACHEROUS AS OTHER WOLVES, THE FEMALE **TIMBER WOLF** IS A GOOD MOTHER! SHE NEVER KILLS — AND EATS HER YOUNG AS THE **PRAIRIE WOLF** IS KNOWN TO DO!



AND HERE'S ANOTHER FREAK BILL! THE CURIOUSLY TWISTED BEAK OF THE **CROSSBILL** IS THE PERFECT TOOL FOR OPENING PINE CONES, ON THE SEEDS OF WHICH THIS BIRD FEEDS!

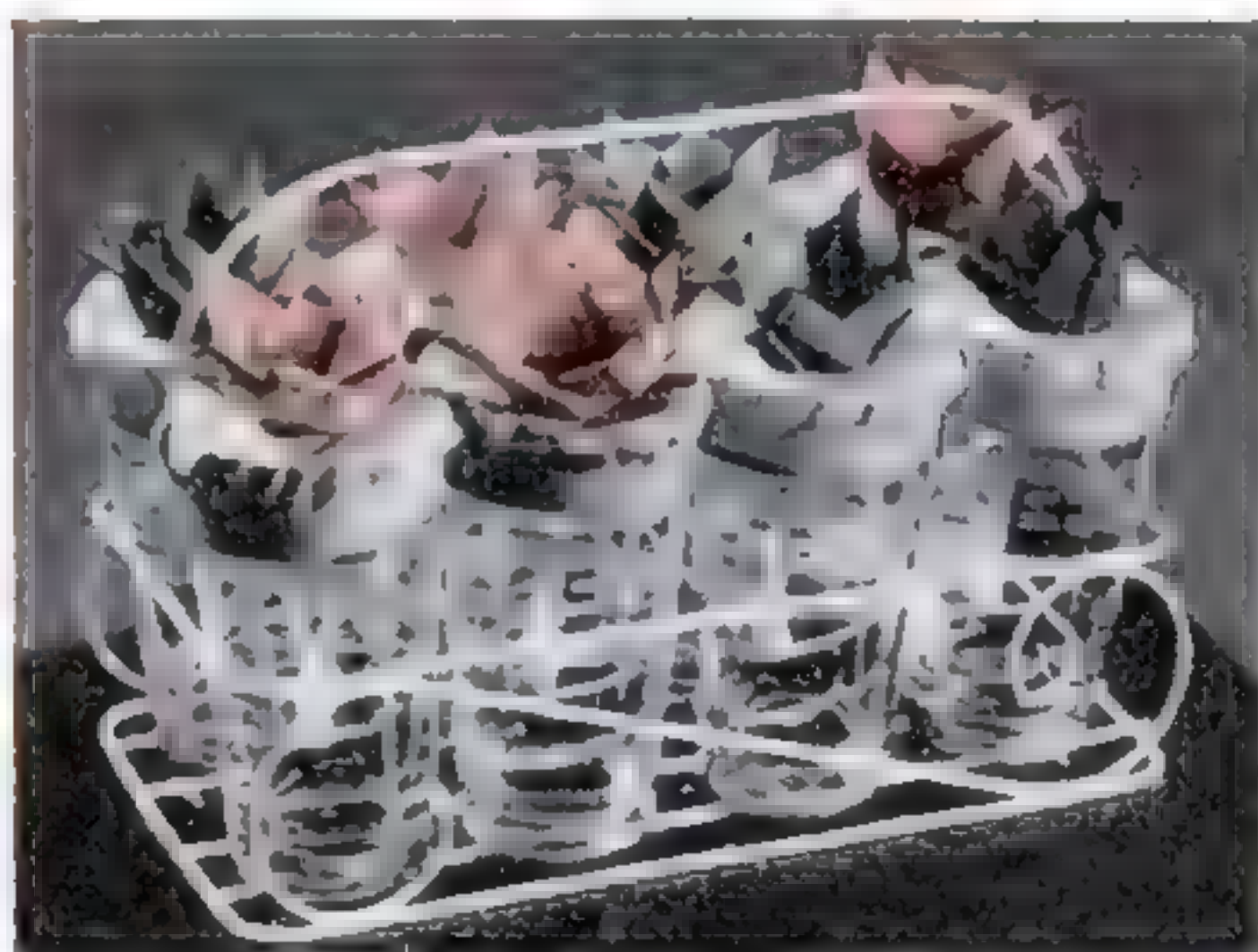


IT IS SAID THAT **LOGGERHEAD TURTLES** FEED ON THE RED-HOT, STINGING **PORTUGUESE MAN-OF-WAR** AND LIKE IT! THERE'S NO ACCOUNTING FOR TASTES!

Handy Helps



SEWING WITHOUT A NEEDLE is made possible by a new chemically treated material that requires only the warmth of an iron, applied through a dry cloth, to join two layers of it together. The gayly striped curtains at the left were created by this method, including the hems, heading, and bands of bright color

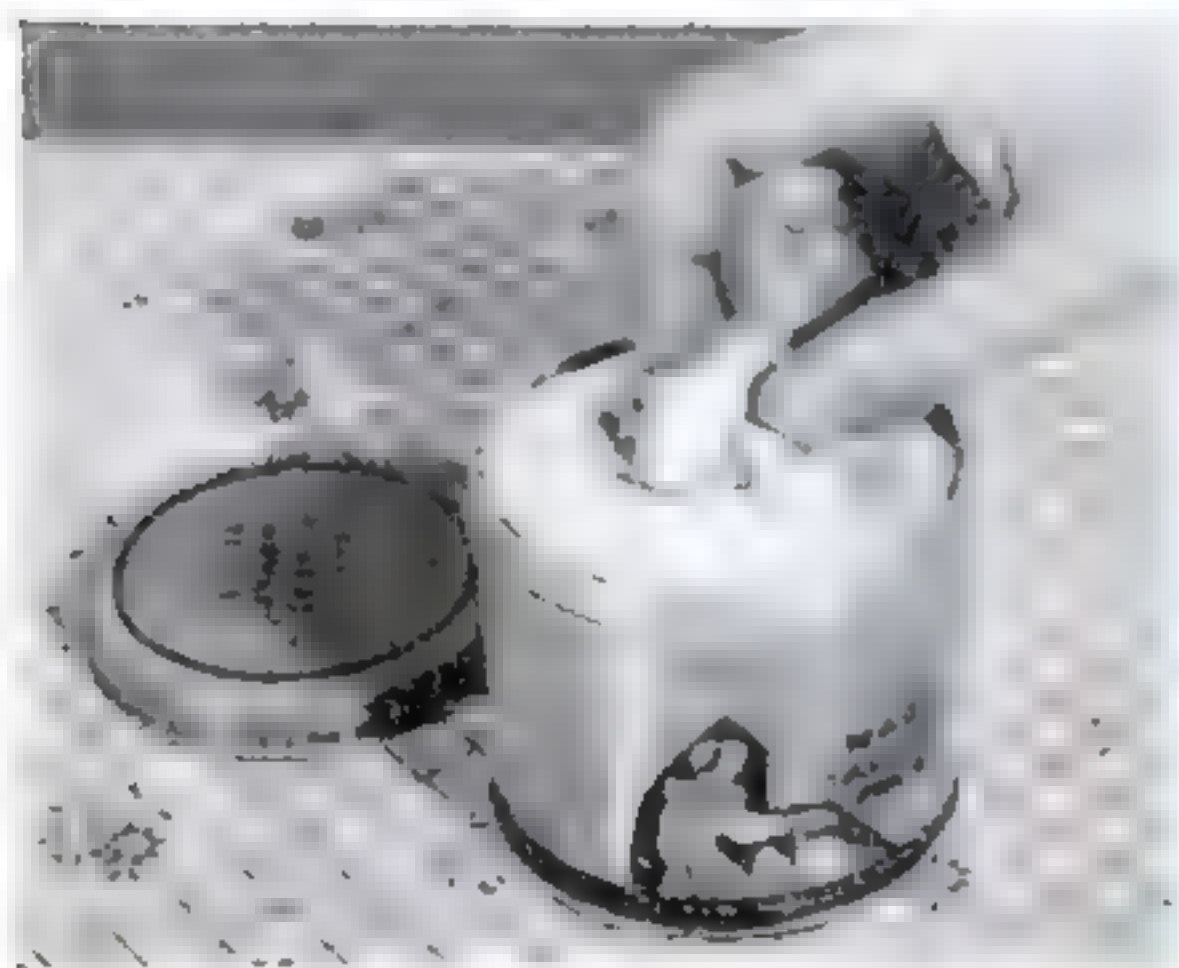


DRINK PROTECTORS. Rubber caps placed on beverage glasses keep drinks cold and clean until they are served. Ornamented with artificial flowers, the coverings fit glasses of any size

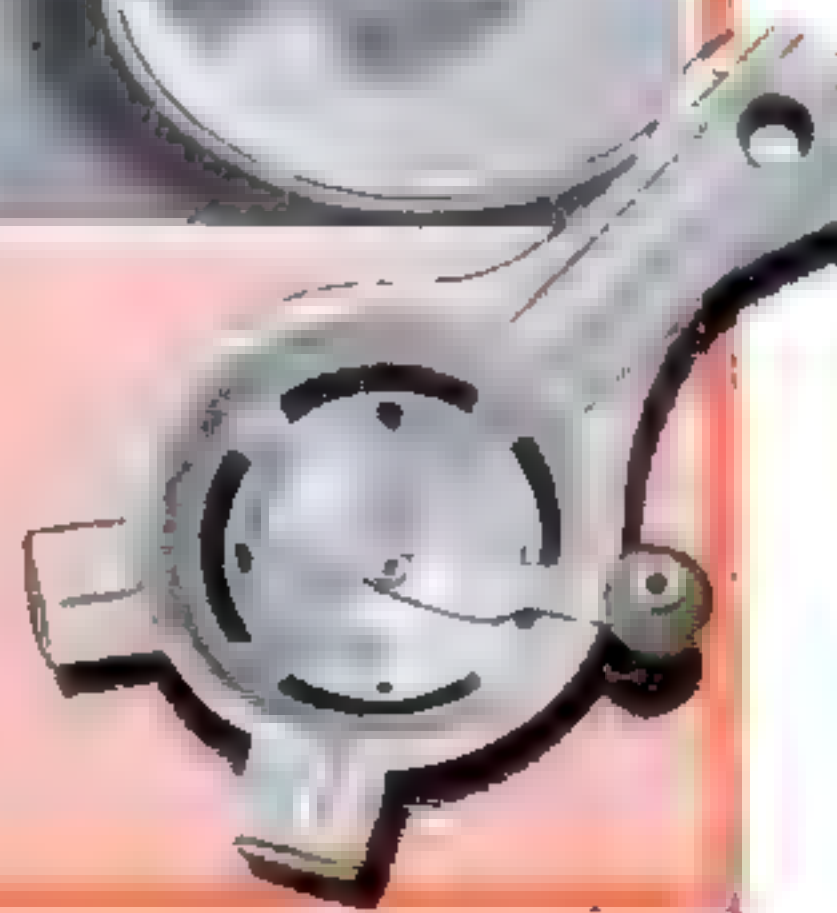


Applying colored stripes to curtains. The warmth of the iron "sews" them on

WADDING POLISH. Polishing metals, mirrors, tiles, and enameled surfaces is simplified by the novel material below. For use, a piece of the chemically impregnated wadding is torn off the pack, as pictured



EGG SEPARATOR. It's no trouble to separate the yolk from the white of an egg if you use this handy device. The egg is dumped into the container and a handle is turned. The white drains off



for Homemakers

SILK STOCKINGS can be laundered in three minutes with the outfit pictured at the right. The hose are placed in a double-globe "shaker" and swirled with water and lather from a special silk soap. Drying is done on a wire frame that is adjustable to insure a fit. The method is said to restore the elasticity of the stockings

FOUR-IN-ONE SAUSAGE. Four kinds of appetizers are combined in the sausage loaf below. In making canapes, the loaf is sliced across and the various sections are broken apart. Flavors include corned beef, spiced ham, liver, and ham and cheese



SANDMAN'S HELPERS. This youngster was sent off to dreamland by a tickless clock, a soft light representing a dwarf, and a toy rabbit that hums a drowsy lullaby



CARBONATED BEVERAGES are kept active by a new attachment which has a point that is driven through the bottle cap. A screwlike valve allows the beverage to fizz out for mixing drinks



He looked into the muffler and began to laugh. "What's the joke?" Knowles inquired

Gus Solves a Stinger

GEORGE KNOWLES is one of those lucky fellows who don't have to let the chore of earning a living interfere with their having a good long vacation every year. He takes off six weeks each summer, and he always spends them in the same way—fishing up in the State of Maine.

So when George, much sunburned and looking better than a million dollars, drove his big car into the shop of the Model Garage late one afternoon, Gus Wilson grinned widely, tamped the glowing long cut down in the bowl of his old pipe, and set himself to hear all about the big ones that George had caught and the bigger ones that he had let get away.

But when George climbed out of his car

and shook hands he looked preoccupied, and very apparently his mind wasn't dwelling on his piscatorial triumphs. "Hello, Gus," he said. "Mighty glad to see you! Everything all right with you? . . . Good! . . . Yes, I had a grand time—tell you all about it sometime soon. But right now I've got this darned car on my mind. It's the most expensive car I've bought for years—that's why I let it stand in my garage and took Jack's old open car up to Maine with me. There's only six thousand miles on the clock of this bus, Gus, but she isn't running right. Not at all right!"

"That's queer," Gus said. "I remember that she was in perfect condition just before you went away. . . No chance that some one was joy riding in her while you were gone,

is there? Stranger things have happened."

"No chance at all!" George maintained. "Everything in the garage was exactly as I had left it—wheels jacked up to save the rubber, and so on."

"What seems to be the matter?" Gus wanted to know.

"I can't put my finger on it," George said. "Everything seems to be working perfectly, but the car hasn't got any pep. Every time I drive it I think it's going to bog down with me. It never does—but that's the feeling it gives me. Take a run down the road in her, Gus. You'll see what I mean before you've gone a mile."

"Sure thing," Gus agreed. He slipped a cover over the driver's seat and got in. George Knowles walked around and got in beside him.

Gus stepped on the starter. The engine took off promptly and purred smoothly. He backed out of the shop, and started to drive slowly down the road. "Runs smooth as cream," he told Knowles.

"Yes," George agreed, "she runs smoothly enough. But step on her, and you'll see what I mean."

Gus pressed his foot down on the accelerator pedal. The car picked up speed, but it had a queer feel to it. "Yes," he said, "you're dead right, George. Something's wrong somewhere. The engine is running perfectly, but the car hasn't got any surge. She runs just the way I feel after I've eaten a big lunch on a hot day. I'll take her back to the shop and give her the once-over."

"Right," George agreed. "Let me out at my house, will you? You can give me a ring when you get her fixed up, or when you find out what's the matter with her, if it's anything serious."

Back in the shop, Gus refilled his pipe and then did some steady thinking. If Knowles's car had been an old one, or even a car on which he never had done any work, its lack of surge and pep would have suggested several possible troubles to him. But the car was next door to new, and Gus

Maybe Somebody "Put the Bee" on George Knowles, But Good Luck and Carbon Monoxide Kept Him from Getting Stung, Anyway

By MARTIN BUNN

had done enough little jobs on it to be sure that it had been in perfect condition just before George had laid it up while he took his six-week vacation.

After thinking things over for a few minutes Gus decided that the carburetor choke valve might be sticking, but on examining it he found that it was working perfectly. So was the float. A careful check of the timing disclosed nothing wrong. Fuel trouble was out: except when he was off on long trips George Knowles always bought his gasoline at the Model Garage, and Gus takes good care that there is nothing wrong with the gas that he sells.

He was scratching his head over the puzzle when Joe Clark called to him from the office that he was going home. Glancing at the clock, Gus saw that it was a half hour after closing time, and realized that he was hungry. So he locked up the shop, got into his car, and drove downtown to get his dinner.

One reason why Gus Wilson is a top-flight automobile mechanic is that he's never able to stop thinking about a puzzling job until he has evolved a way of licking it. So all the time he was eating he was thinking about Knowles's car. "Never heard an engine that ran more nice and quiet," he said to himself. "Hey! Maybe that's it! That engine of George's runs too quiet! By gum! I'll have to take a look!"

He hurried through his dessert, drove back to the garage, let himself in, and switched on the shop



Gus started the motor, walked to the back of the car, and put his hand over the exhaust

lights. While he was taking off his coat he heard a car stop outside and then drive off, and a moment later George Knowles came in.

"Just happened to be passing with a friend," he explained, "and saw your lights go on. Well, have you found out what's the matter with that bus of mine?"

"No, I haven't," Gus told him. "But while I was eating my dinner I had an idea. If you want to wait a few minutes, I'll tell you whether or not it was a bright one."

"Sure—go ahead," Knowles said.

Gus started the engine and let it idle. Then he walked around to the back of the car and put his hand over the end of the tail pipe of the muffler.

"Yep—it was a bright idea!" he said. "I thought that engine was running too quietly. I can scarcely feel the exhaust coming out. That locates the trouble, George. It's either in the exhaust pipe or, more likely, in the muffler. It won't be long now!"

He took off the muffler and exhaust pipe. He pushed a flexible cable through the pipe with ease, proving that there was no obstruction in it. Then with the aid of a bright light, he looked into the outlet port of the muffler, and a minute later he started to laugh.

"Hey, what's the joke?" Knowles wanted to know.

"The joke's on you—on us," Gus said, pointing to what looked like a ball of mud just inside the rear end of the muffler.

"What the devil is that?" Knowles demanded.

Gus laughed some more. "That's a wasps' nest," he said. "While you were gallivantin' around up there in Maine some nice industrious insects set up housekeeping in your muffler. And they built their happy home so big that the exhaust couldn't blow it through the tail pipe. Naturally, the obstruction in the muffler caused back pressure, and enough loss of power to give your engine that dead feeling when you stepped on the accelerator pedal. You're not stung, George—but you might have got stung real bad if the old carbon monoxide hadn't done in those wasps!"

HE CLEANED out the muffler with a stick, and replaced it and the exhaust pipe. Then he got into the car and raced the engine. "Perfect!" was his verdict. "Pep to spare!"

Lights burning after hours in the shop of the Model Garage always are an irresistible magnet for Gus Wilson's customers, many of whom are his near neighbors and all of whom are his warm friends.

Before George Knowles had time to drive out, genial Dr. Marvin, on his way home from the last call on his evening round,

came in and settled himself comfortably in the only chair. Then young Jack Simpson appeared, said "Thought I'd find you here!" to his father-in-law, and perched himself on Gus's workbench. State Trooper Jerry Corcoran rode up on his motor cycle in what sounded like a blast of machine-gun fire, and joined the gathering. And then lean Tim Sheridan, Gus's most ardent disciple, parked his "Screwball Special" out front and came in with his blond hair on end and his dog Dodger at his heels, to smoke home-made cigarettes and to imbibe automotive wisdom at the feet of his master.

IN A few minutes the shop was full of tobacco smoke and conversation. George Knowles told all about his fishing trip. Then Gus told about the wasps' nest in the muffler of George's car.

"Mufflers," Jerry Corcoran said. "That reminds me of how I stuck my neck out last Sunday, and darned near broke the first rule they taught me when I went on the cops."

"What rule is that?" Dr. Marvin asked.

"Never to start anything that you can't finish, Doctor," Jerry said, grinning. "And that's just what I almost did!"

"I guess you all know that little church about five miles out on the dirt road. A lot of people who live back in the country attend it, and some of them aren't such very good drivers. They park their cars in a field beside the church, and when they start home after the morning service they're likely as not to get in trouble and tangle up the traffic. That dirt road is narrow, with a high crown, and shallow drainage ditches on each side of it, and low clay banks on the outer edges of the ditches. So I make a point of being out there at noon on Sundays, to keep things moving."

"Last Sunday I was a few minutes late—I had to chase a fellow who was doing seventy-three on the highway, and write him out a ticket. When I came in sight of the church I saw that there were a half dozen or so cars tied up on either side of it. And when I got past the cars on my side I saw what was tying them up—an old sedan which was stalled right across the road, with its rear wheels in the ditch."

"I rode up to it, and got off my motor cycle, all set to bawl out the driver for trying to turn around in a place like that. But, when I got an eyeful of the driver, I saw that she was a darned pretty girl, and that she was all hot and bothered about the trouble she was causing. So instead of bawling her out I asked her what was the matter and if I could help her. She said that when she had turned into the road in front of the church (*Continued on page 240*)

THE HOME WORKSHOP

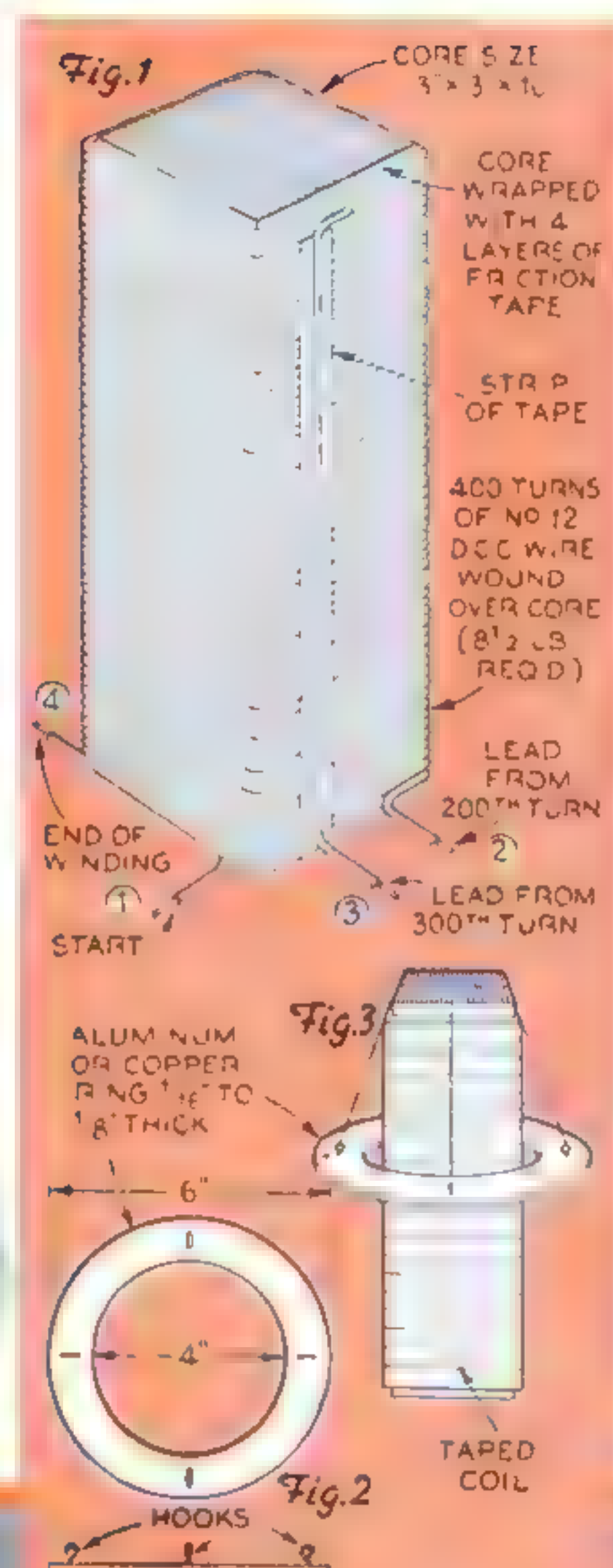


For This Issue. A NEW SHIP MODEL • HALLOWE'EN STUNTS
MINIATURE ENLARGER • RADIO • REBULSION COIL

Giant Repulsion Coil



When the switch is thrown, an aluminum ring is shot into the air by the coil



By KENDALL FORD

WITH this easily built repulsion coil, amazing electrical stunts can be performed like some of those that fascinated the spectators of two of the most popular science shows at the New York World's Fair last summer.

Large aluminum or copper rings may be shot into the air with considerable force, and plates of the same material may be made to float in air, apparently nullifying the force of gravity. Water may be brought to the boiling point and an egg may be fried in vessels held above the coil, all without the application of outside heat. In



Method of winding coil, a ring of suitable size, and one way to support it. Below, boiling water on the coil, here hidden by a box

MAKES METAL FLOAT MYSTERIOUSLY IN THE AIR AND FRIES EGGS OR BOILS WATER WITHOUT EXTERNAL HEAT

fact, the operator can hold his hand between the coil and the kettle or frying pan. Copper or aluminum pans are best; iron vessels may be used, but there is a tendency for them to be pulled down to the coil.

These mystifying stunts are made possible by utilizing the principle of induction. The repulsion coil acts as the primary of a transformer, and the metal plate, ring, or vessel serves as the secondary in which high currents are induced.

To build the repulsion coil, obtain sufficient old transformer laminations (approximately 22 lb.) to make a core 3" square and 10" long. If transformer laminations are not available, No. 24 or 26 stovepipe iron may be substituted, but each piece should be shellacked and allowed to dry before the core is assembled. Stack the core pieces into an even pile and bind them tightly with three layers of friction tape.

Wrap a layer of thin cardboard around the core and proceed with the winding, which consists of 400 turns (8½ lb.) of No. 12 double cotton-covered wire, with taps brought out from the 200th and 300th turns. The starting lead, with about 6" of wire protruding (marked No. 1 in Fig. 1) is secured by tying string around the core. Exactly 100 turns of wire should be wound in

each layer so that the taps for lead No. 2 and lead No. 3 may be made at the end of a layer. Where the connections are made for leads No. 2 and 3, the joints should be soldered and thoroughly taped.

Since the coil may sometimes be used on 220 volts, it is advisable to place a layer of thin cardboard between each layer of wire to prevent a possible short circuit. Also, cover lead No. 3 with a strip of tape, as shown in Fig. 1. When the coil is wound, apply a coat of shellac or insulation varnish and cover it with a layer of friction tape.

A suitable ring is shown in Fig. 2. Because of its large current-carrying capacity as compared to its weight, a ring made of ⅛" aluminum seems to give the best results. Either copper or aluminum of a different thickness may be used, but the ring must be in one piece.

To project the ring into the air, it should be placed a little above the center of the coil. This may be accomplished by placing hooks on the ring and tying pieces of thread between the hooks, as shown in Fig. 3. Another method, illustrated in one of the photographs, is to build a wood frame that fits over the coil and holds the ring in position.

If a box is placed over the coil, an aluminum or copper plate (containing at least 1 sq. ft. of metal) may be made to float above the box without any apparent cause. A kettle of water will quickly come to a boil when placed on the box over the coil. Flash-light bulbs with their terminals connected to a few turns of wire will light up brilliantly if brought near the box.

In all experiments where effects of repulsion are expected, like the projected ring and the floating plate, the metals used must be nonmagnetic such as aluminum or copper. When the ring is in place over the coil, a heavy current is induced in the ring as soon as the current is sent through the coil. Since the current flowing in the ring is opposite to that flowing in the repulsion coil, it will set up a heavy magnetic field, which tends to force the ring away from the coil. If the ring were iron or some other magnetic



substance, the pulling effect of the repulsion-coil core would offset the tendency of the ring to move upward, and the ring would remain stationary.

The repulsion coil is arranged with several leads so that it can be adapted for a particular experiment, or used on either 110 or 220 volts. When leads No. 1 and No. 4 are connected to the line, the current con-

sumption on 220 volts will be approximately 18 amperes, and on 110 volts, 9 amperes. These terminals should be used where the current is to be left on for a time, as with the floating plate and water-heating or cooking experiments. Terminals Nos. 1 and 2, and terminals Nos. 1 and 3, should be used for periods of short duration, as in the projected-ring experiment.

Harmonica and Kazoo Combined



Either instrument may be played separately or they can be combined to obtain special effects

BY COMBINING a harmonica and a kazoo as shown, it is possible to change instantly from one to the other and get a wide range of tones above and below the regular harmonica scale, as well as a variety of trumpet and blue notes.

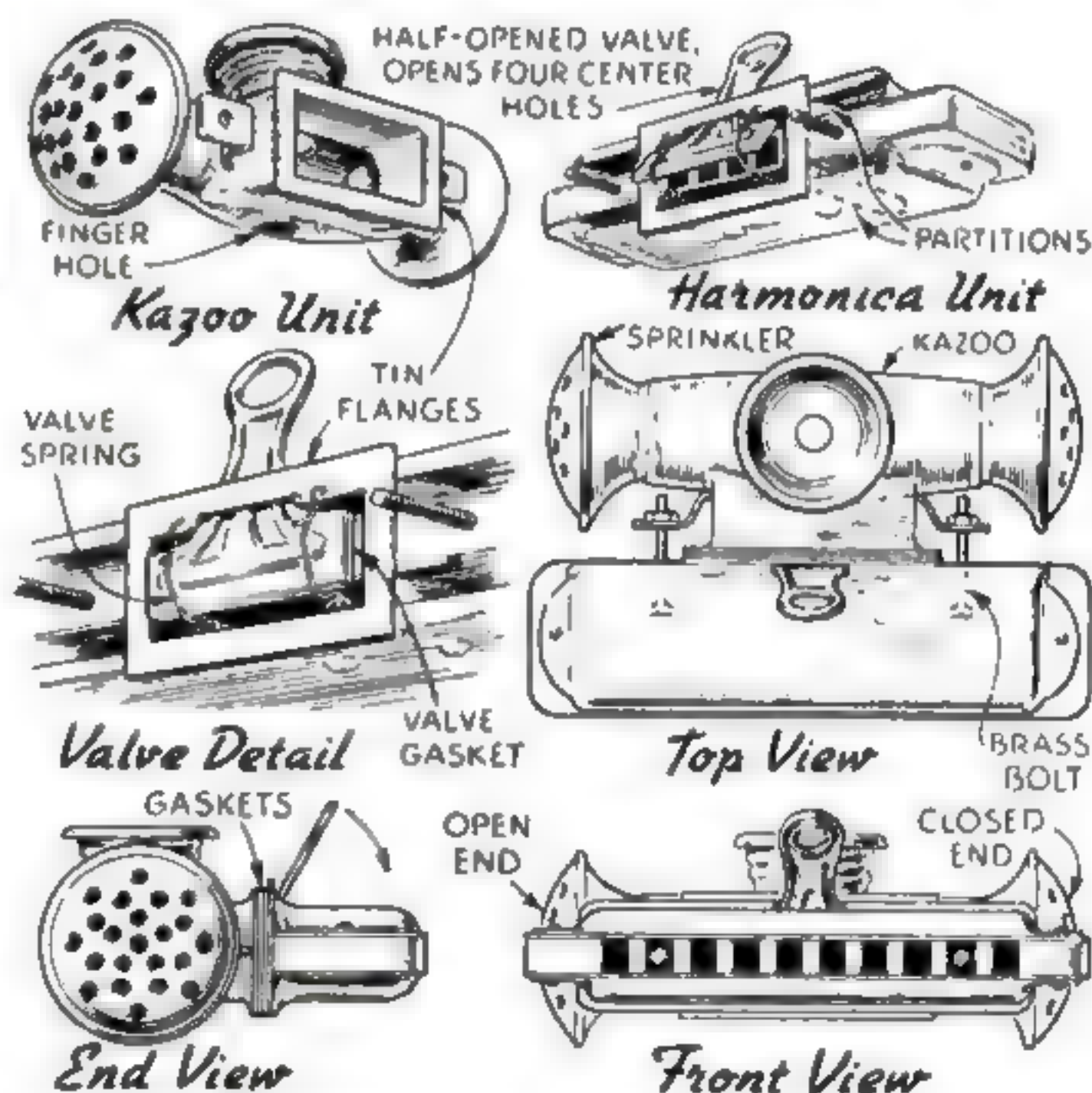
A ten-hole harmonica is used, and the four center holes are drilled right through the back. These holes are then closed by means of an improvised valve of the accordion type, which can be made from a small spring paper clip. A suitable kazoo is then mounted on the back of the harmonica by means of two small brass screws and nuts, holes for which can be drilled through the second and ninth openings of the harmonica. If a plain kazoo is used, it can be made more ornamental, as in the model illustrated, by attaching two small aluminum sprinkling caps such as are sold for moistening clothes. They can be fastened with so called "cold" or liquid solder.

There has to be a hole in the back of the kazoo to permit air to escape when the center holes of the harmonica are being used.

IN ONE INSTRUMENT

This hole is closed with one finger when the kazoo is in use. It is also necessary to have a small hole in one end of the kazoo, although this is hidden in the model by one of the aluminum caps. As an ornament, the writer clipped a souvenir World's Fair brooch over the mouth of the kazoo.

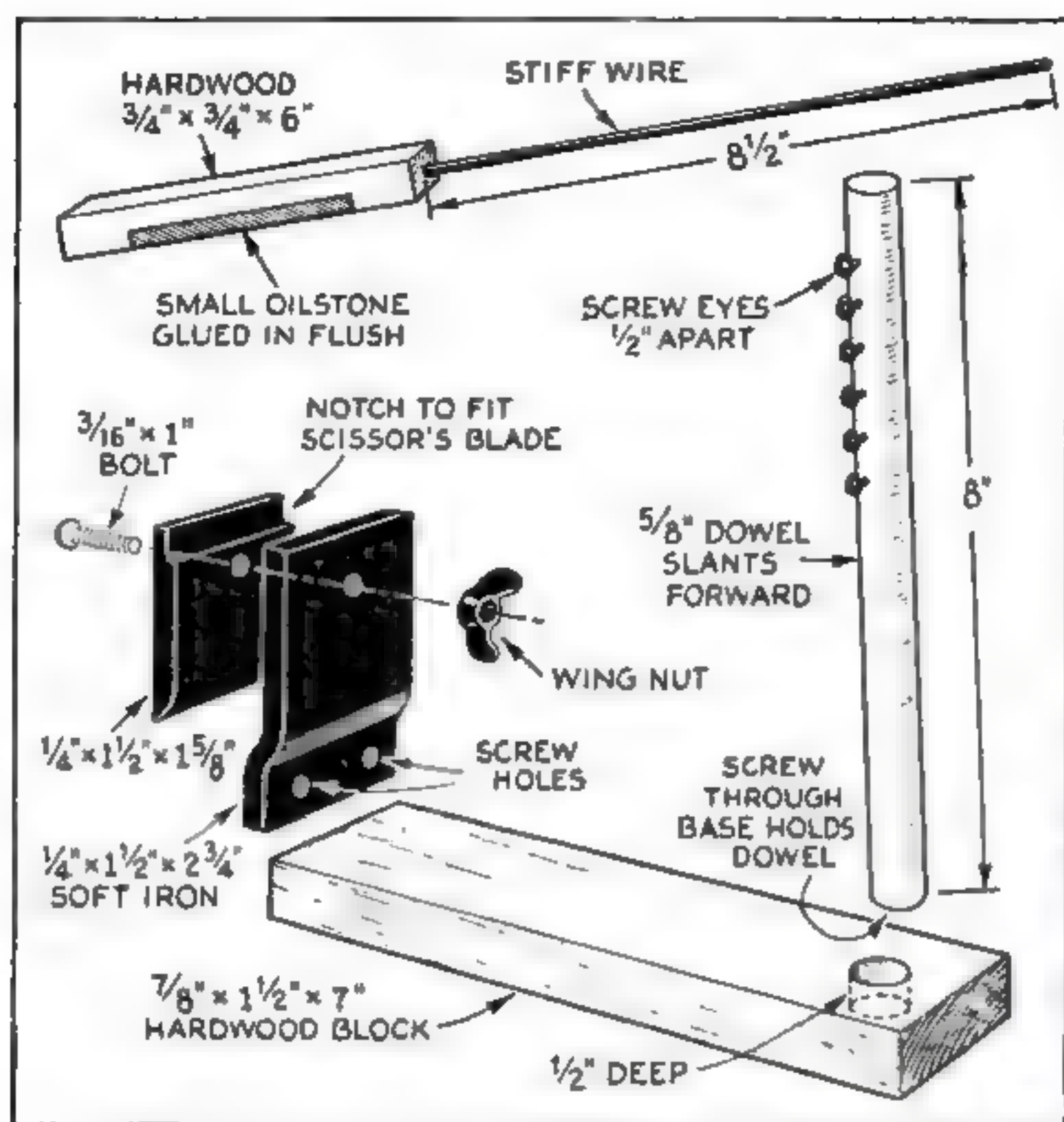
The harmonica is played in the usual way. When the kazoo effect is desired, the valve is pressed, thus opening the four center holes. The player can then hum into the kazoo without causing the reeds of the harmonica to vibrate.—H. GIFFORDS.



A ten-hole harmonica is used. The four center holes are drilled through and a valve attached

Refastening a Window Shade

SOMETIMES a window shade will pull loose at one side where it is attached to the roller. If small tacks or other fasteners are not on hand, a good repair can be made by re-fastening the shade to the roller with several strips of cellulose tape or other gummed tape.—BYRON E. BOWLES.



Scissors Sharpened Perfectly in a Jig

A BARBER devised the jig illustrated for sharpening the scissors used in his own shop as well as many brought in by customers after they discovered his skill in putting a keen edge on old shears.

Any small oilstone or whetstone that can be inlaid into the handle may be used. After the jig has been assembled, the scissors are clamped in place pointing to the left. The oilstone is then laid on the blade to be sharp-

ened at exactly the same bevel to which it was originally ground. The guide wire is run through whichever screw eye comes closest to holding the stone at that angle. A circular motion is then imparted to the sharpener with the right hand while the left hand holds the base down securely. With a stone guided in this way, anyone can learn to sharpen scissors perfectly after a little practice.—W. KEITH VINING.



Tubing Keeps Lock from Marring Enamel

A BICYCLE lock is likely to wear the paint off the fork where it rubs against the enamel. This can be prevented by slipping a length of rubber tubing on the shackle of the lock. The rubber also eliminates objectionable rattling when the lock is being carried while riding.—CHESTER MOWERY.

Tape Forms Bands on Models

MAST bands for ship models can be made from narrow strips of cellulose tape applied in a sufficient number of layers to give the desired thickness. When painted black, these look like iron bands.—ANTONIO GELINEAU.

Tack Puller and Driver Made to Fit Pocket

A POCKET tack puller and driver can be made, as shown, from the shank of a discarded cold chisel about 4" long. The end is cut at a slight angle, and the slot is made by using two blades in a hacksaw frame. The end is next ground off to give the claw a sharp edge. A second slot is then sawed through the front of the claw. This tool will hold a tack in the best position for driving, the weight of the shank being sufficient to sink even large tacks easily into softwood or hardwood.—W. C. WILHITE.



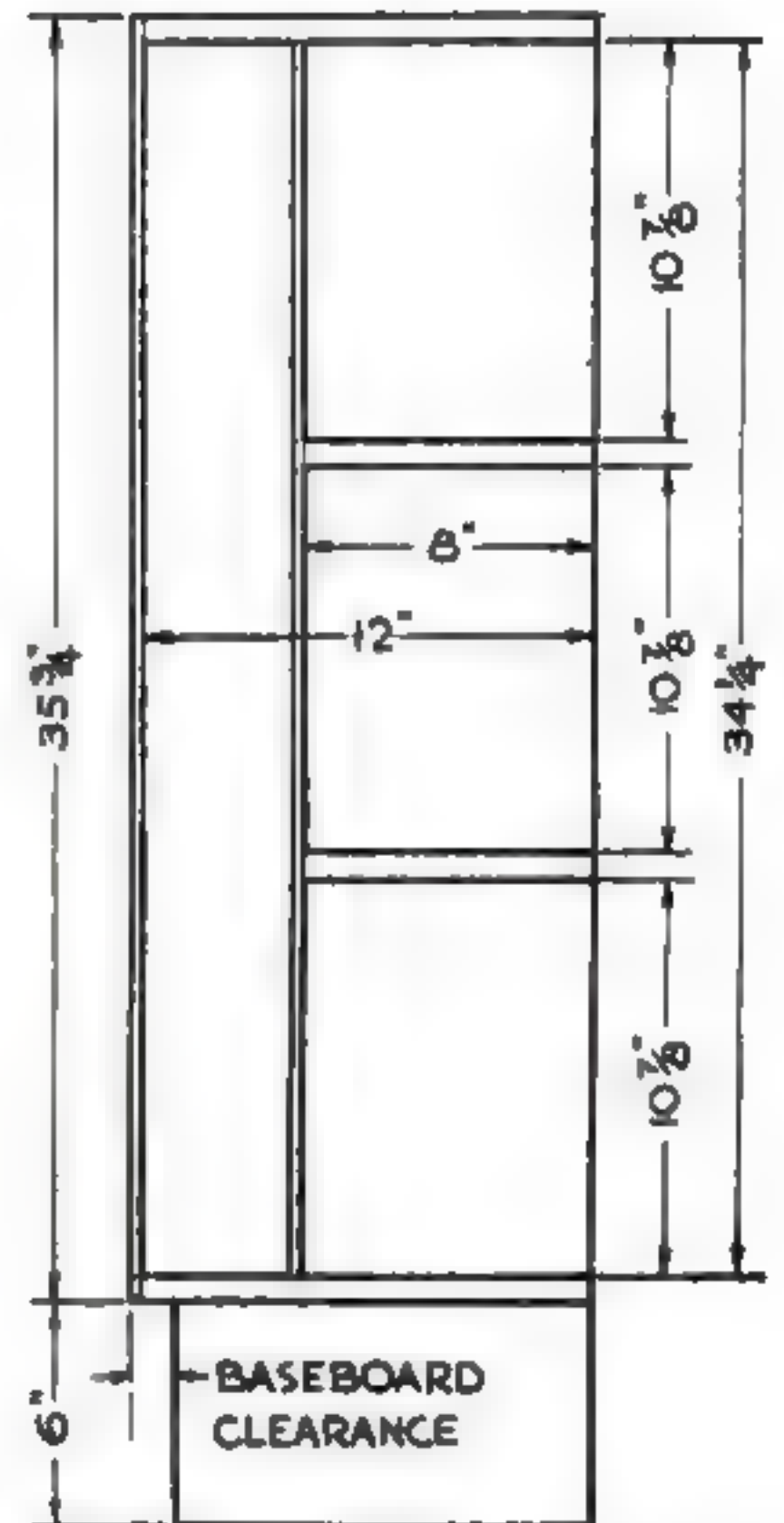
Cut from the shank of an old cold chisel, the tool grips tacks easily

FOLDING CARD TABLES

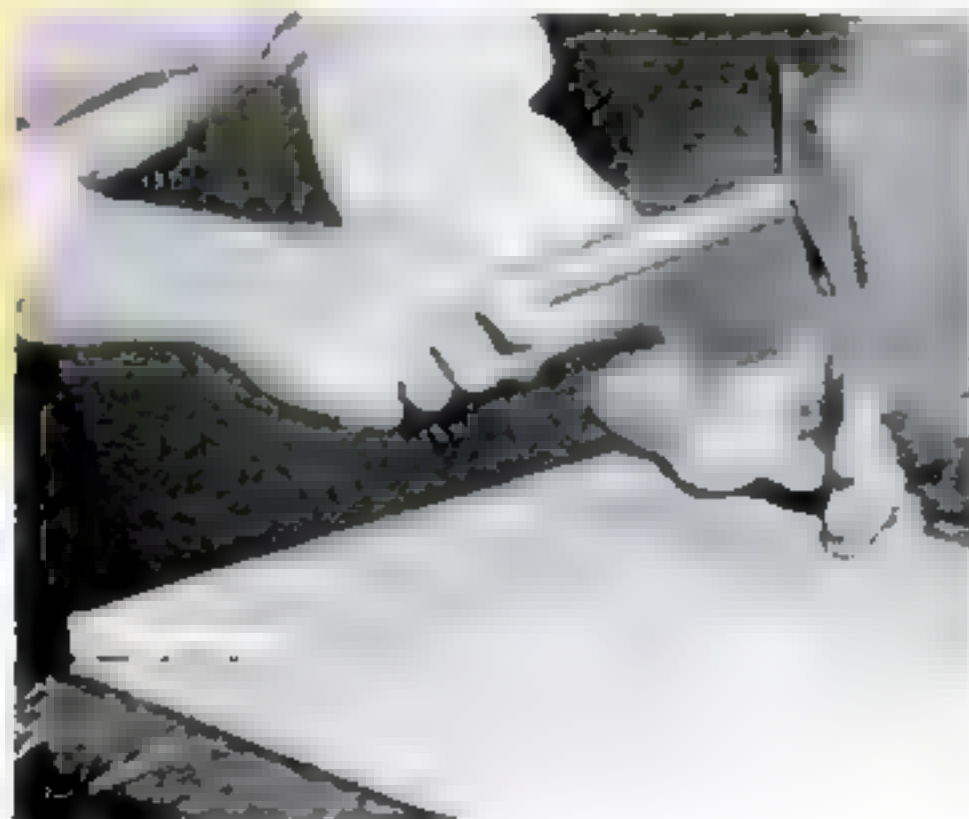
Novel



Books as large as 8" deep can be accommodated on the shelves and there is a space nearly 4" wide in back for a card table. Score pads, pencils, and other odds and ends can be kept in the cabinet



Use $\frac{3}{8}$ " dowels for holding the shelves and uprights together. Right, countersinking the brads that hold the molding in place



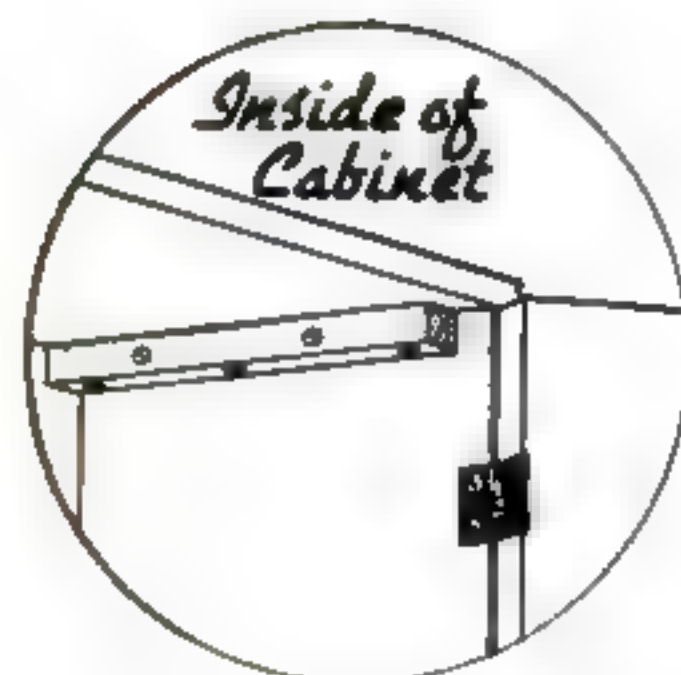
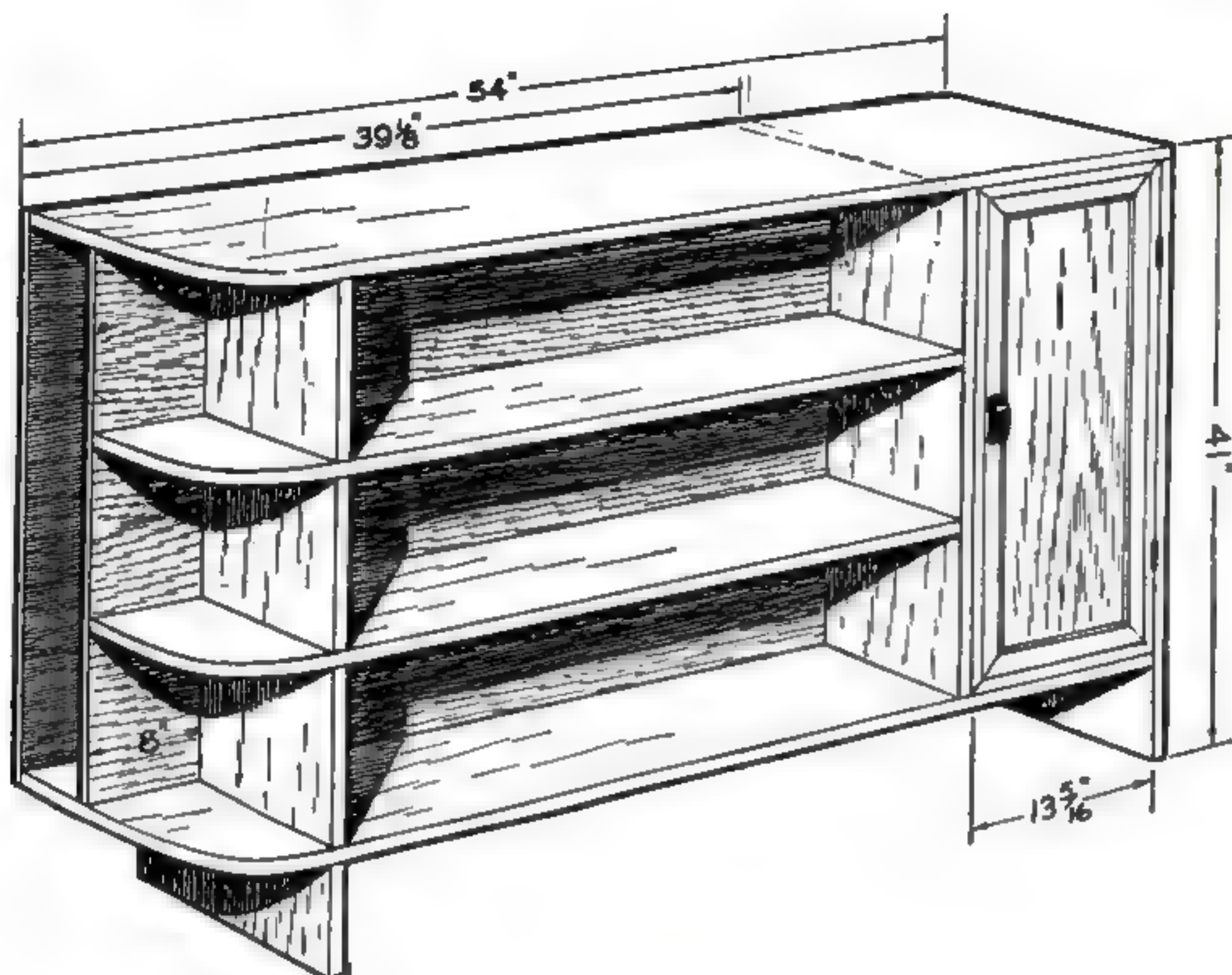
WHERE to store card tables when not in use is a troublesome problem in most homes. A novel solution is to keep them in a pair of bookcases like those illustrated. Although at first glance nothing appears to be unusual about the bookcases, they are a little deeper than usual and have a double back between which the folded card tables can be placed.

White pine or other suitable soft wood $\frac{3}{4}$ " thick is used for building the cases. For each bookcase order three pieces of wood 8" by 40", two pieces 12" by 41", two pieces 12" by 54", two pieces of three-ply wood 3' by 5', and about 10 lineal feet of molding for trimming the door.

Cut the parts as indicated in the drawings and begin the assembly at the bottom by screwing the leg with its brace securely to the bottom board. Continue to build up the framework by using screwed joints wherever the screw-heads will not show.

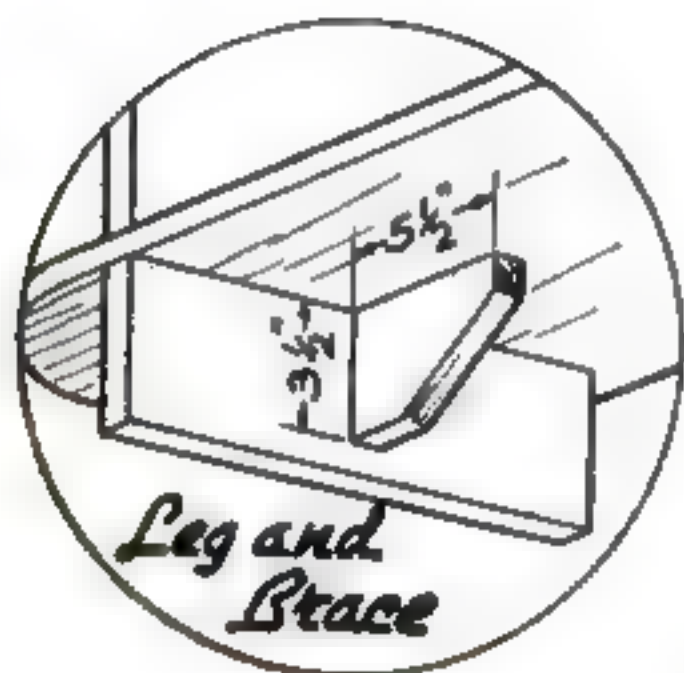
CAN BE STORED IN THESE

Twin Bookcases



The case is reinforced by screwing $\frac{3}{4}$ " square pieces to the four inside corners. At left, perspective sketch with the principal dimensions

By
**JEROME
UHRIG**



In places where screws would be visible, fasten the joints with $\frac{3}{8}$ " by $1\frac{3}{4}$ " dowels. Use two dowels for joints between 8" wide boards and three dowels for those 12" wide.

The case can be reinforced by screwing $\frac{3}{4}$ " square pieces to the four inside corners of the cabinet as shown in a detail drawing. These strips will also act as a door stop. The door is cut from plywood to fit the opening, and the molding is mitered around the edge on the face of the plywood and fastened with brads. Plane the door to give a clearance of $\frac{3}{32}$ ".



For a different window arrangement, the length may be changed as required

The plywood that forms the back of the shelving is nailed only to the shelves. A second and larger piece of plywood covers the entire back, including the cabinet. The card table slides in between these two sheets of plywood. The bookcase may be stained or painted as desired to match the furniture in the room.

Turntable Base Improves Bedside Alarm Clock

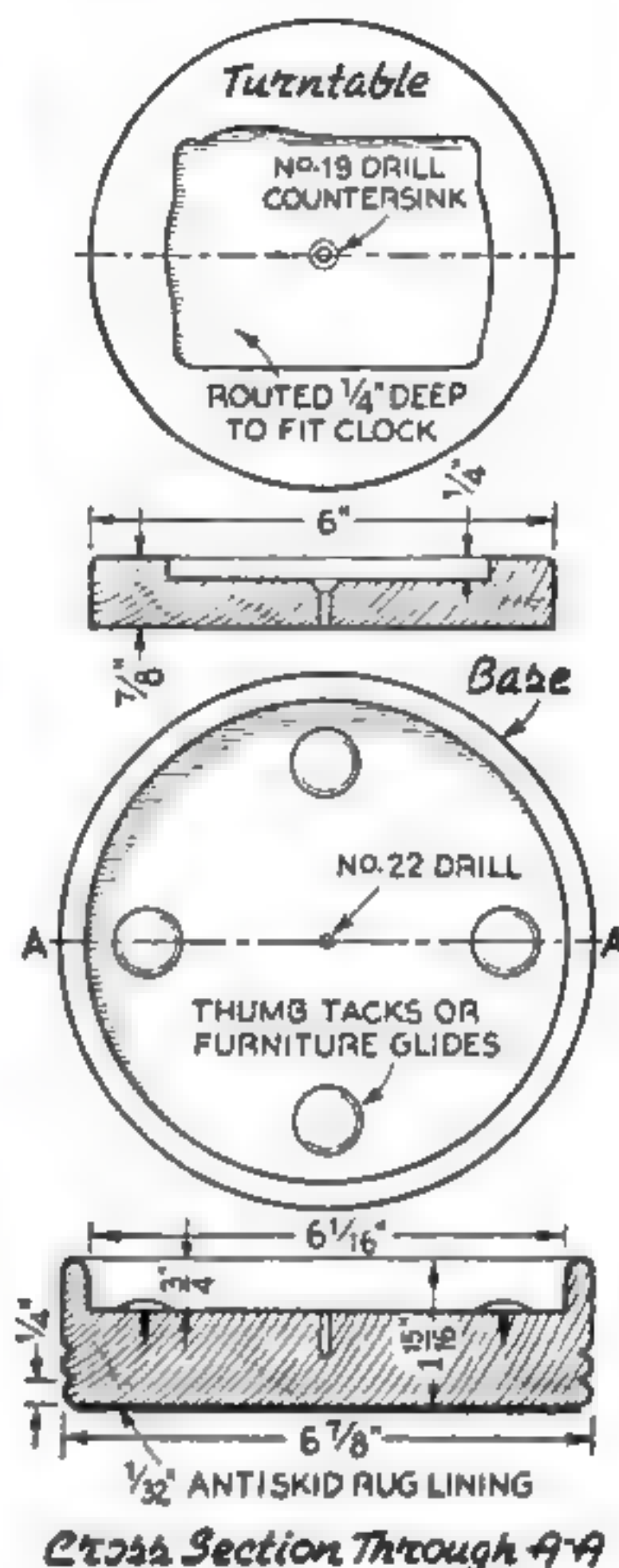


When attached to a small turntable, the clock does not have to be lifted from the bed stand to shut off the alarm or to see its face

AN ALARM clock used on a night table can be improved by making a turntable base for it as illustrated. It is then possible to rotate it and shut off the alarm without picking it up, and there is also less danger that it will be pushed off the table or dropped.

Both the turntable and the base are simple faceplate turnings. The upper piece is routed $\frac{1}{4}$ " deep so that the clock will fit tightly into the recess. To reduce friction between the two parts, four metal thumb tacks or small furniture glides are driven into the lower section as indicated. A No. 8

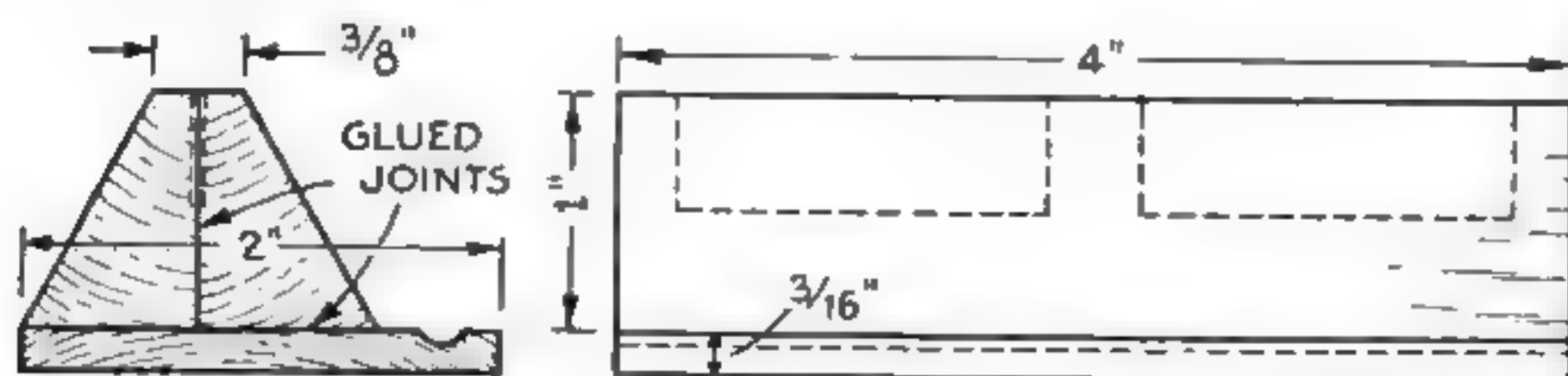
Both the turntable and its base are simple faceplate turnings made as shown at the right

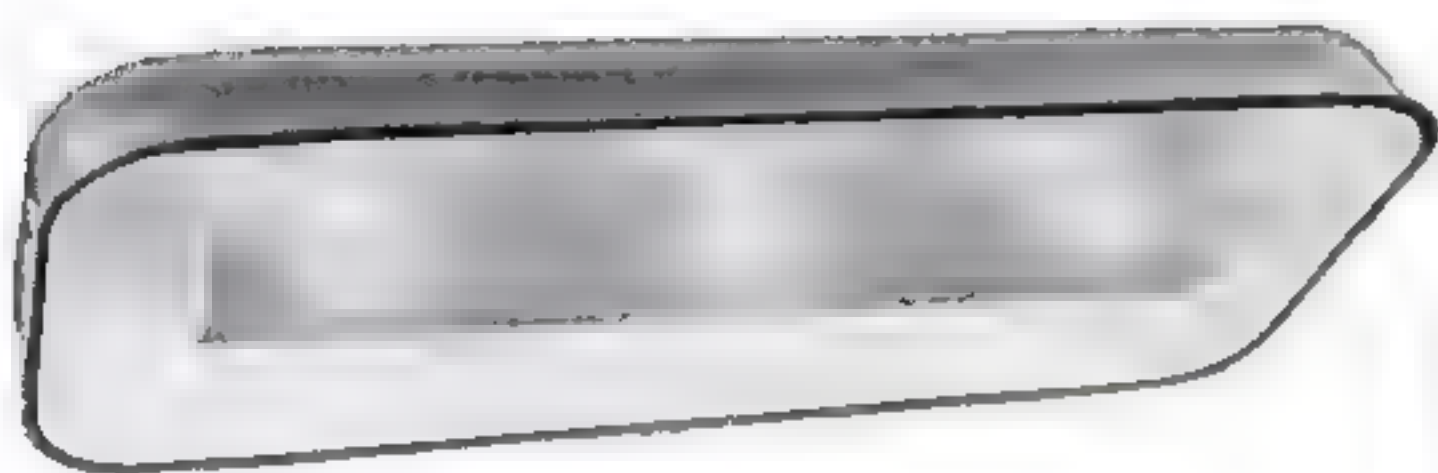


wood screw holds the parts together. A disk of antiskid rug backing is cemented to the underside of the turntable so that it will cling securely to the surface of the bedside stand. No doilies or other woven fabrics should be placed beneath this clock base, of course.—ALVAH S. JAMIESON.

Razor-Blade Holder for Use on Craftsman's Worktable

STIFF-BACKED safety razor blades are used by many model makers and craftsmen, but they are dangerous when left lying near the work because they are likely to be forgotten, and a sudden move of the hand may result in a serious cut. It is much safer to make a holder or stand for them such as the one illustrated. This keeps the blades out of the way, yet it allows them to be picked up and put back quickly. The holder also has a place for a pencil. Any available scraps of wood may be used to make the holder. Use glue and brads to hold the parts together.—D. W. CLARK.

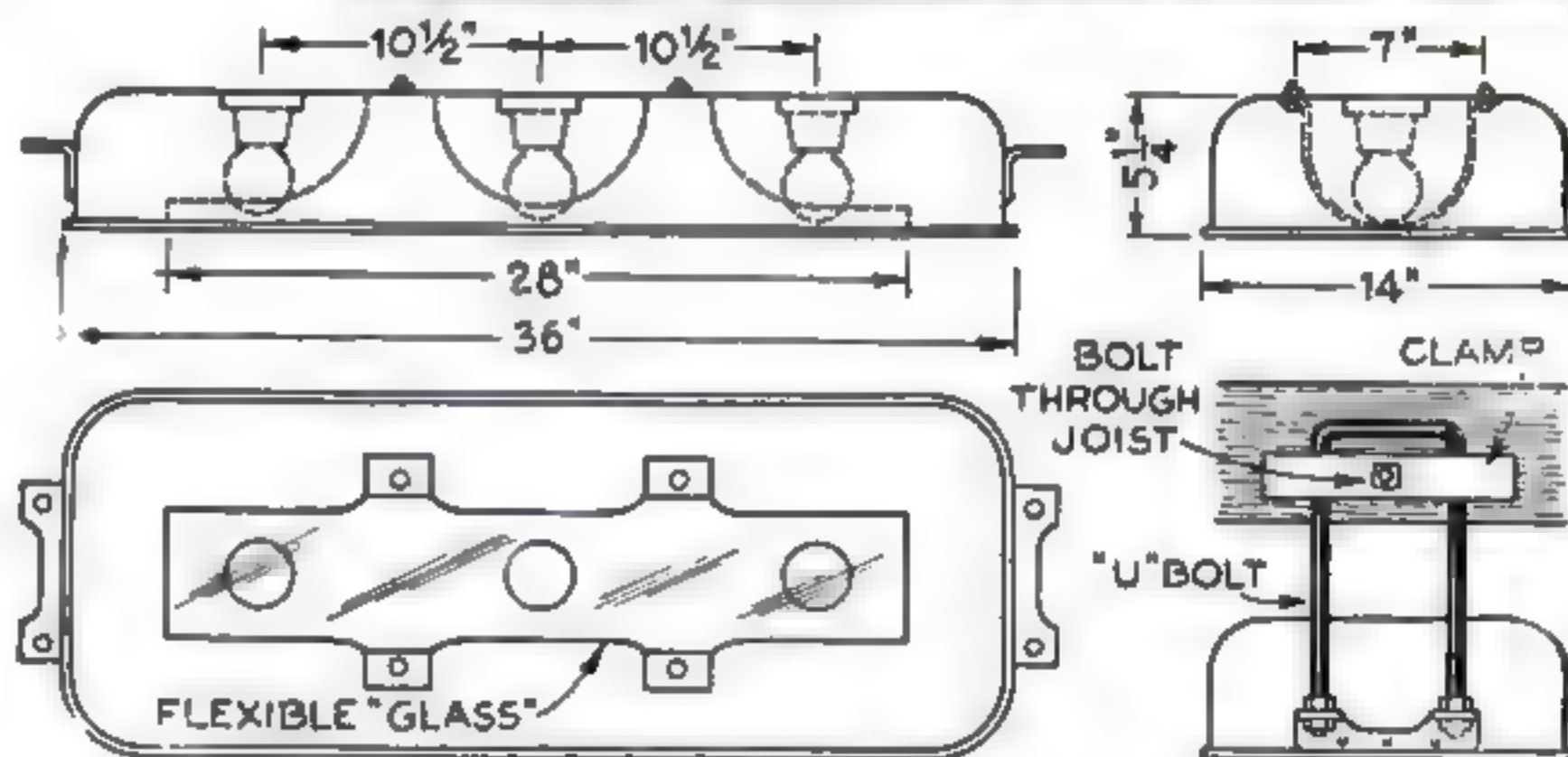




Old Auto Gas Tank Forms Lighting Fixture for the Workbench

HALF an old automobile gas tank, if split along the center seam, forms an excellent reflector for lights above a workbench or shop machine. Select a tank made of two pressed steel halves with rounded ends and corners, joined with a lock seam. As the soldered seam is not readily opened, cut on one side of it with a one-end hack saw, a cutting torch, or a ripping chisel. The baffles to prevent splashing may give a little difficulty if the saw is used, but they can be removed by melting the solder with a torch. Leave the seam as a bead to finish the edge. The supporting brackets on the end may be used to hang the reflector from the shop ceiling.

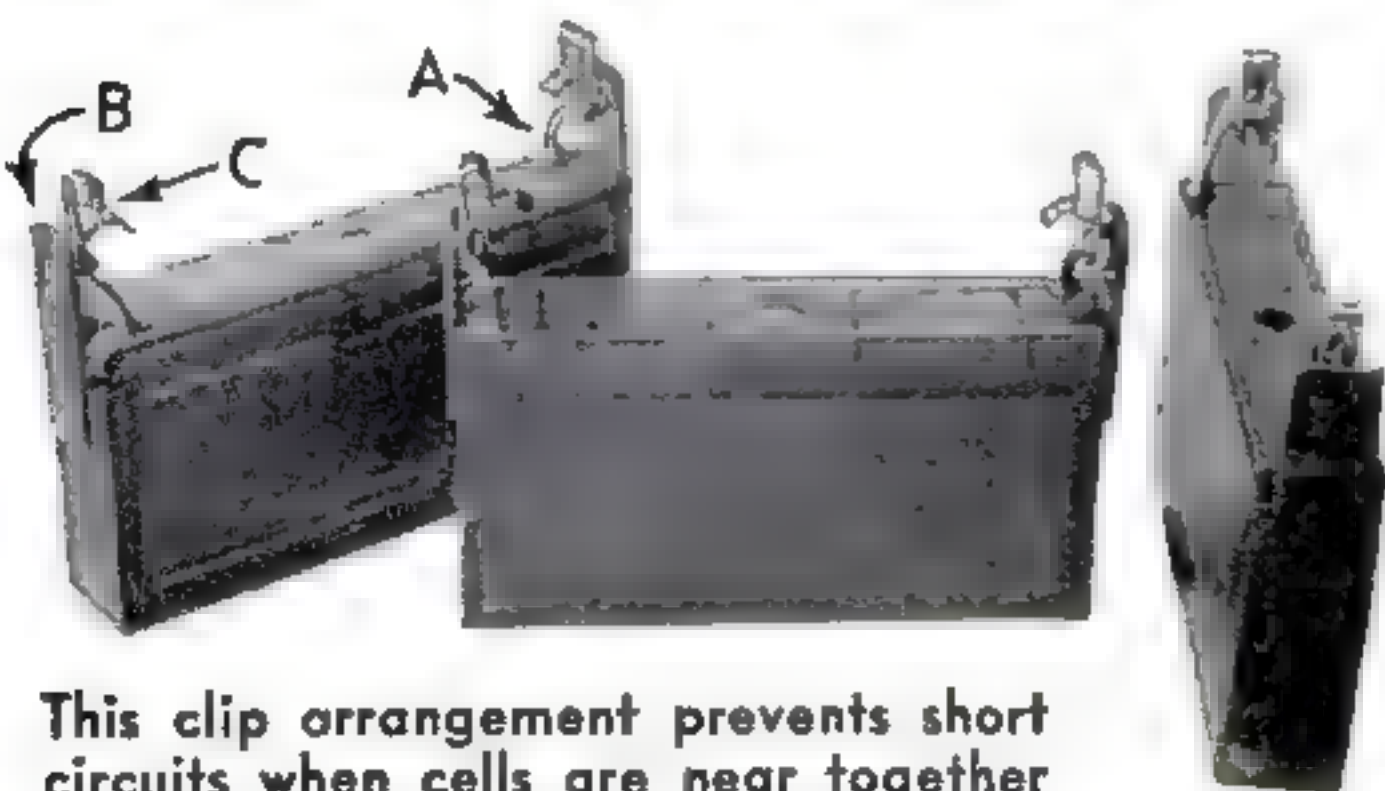
The inside surface is finished with aluminum paint; the outside with aluminum paint to which a little green pigment has been added. The translucent diffusing and reflecting screen is inexpensive flexible "glass"—really a wire screen with the meshes filled with cellulose acetate. Three 40- or 50-watt lamps will generally be sufficient. The fixture is controlled by a wall or ceiling switch.—R. L. KUNAU.



The inside is painted aluminum and three lamps are installed

Hints on Assembling Small Storage Batteries

MODEL makers and experimenters who have occasion to build small storage cells by cutting down regular battery plates (see P.S.M., June '31, p. 108) can profit by sev-



This clip arrangement prevents short circuits when cells are near together

eral ideas I have found practical. One is to use wire solder for connecting the plates and bringing out the leads as shown at A. The second is to mount a strip of celluloid at each end of the jar to hold the binding posts as indicated at B. This keeps the posts high and dry to prevent corrosion. Fasten the clips to the celluloid in the position shown at C so that there is no danger of a short circuit when the cells are placed close together.

The jars themselves are made of 3/32" thick celluloid. After being cut to size, the pieces are cemented with a liberal application of transparent cellulose household cement.—R. W. WAGNER.



Rubber Coating Prolongs Life of Wringer Rolls

WHEN the rubber rolls of a wringer become old and cracks appear, their useful life and appearance can be prolonged by painting them with a white rubber-base tire coating of the type now obtainable at most automobile supply stores and public garages. After being applied, the material should be allowed to dry for several days.

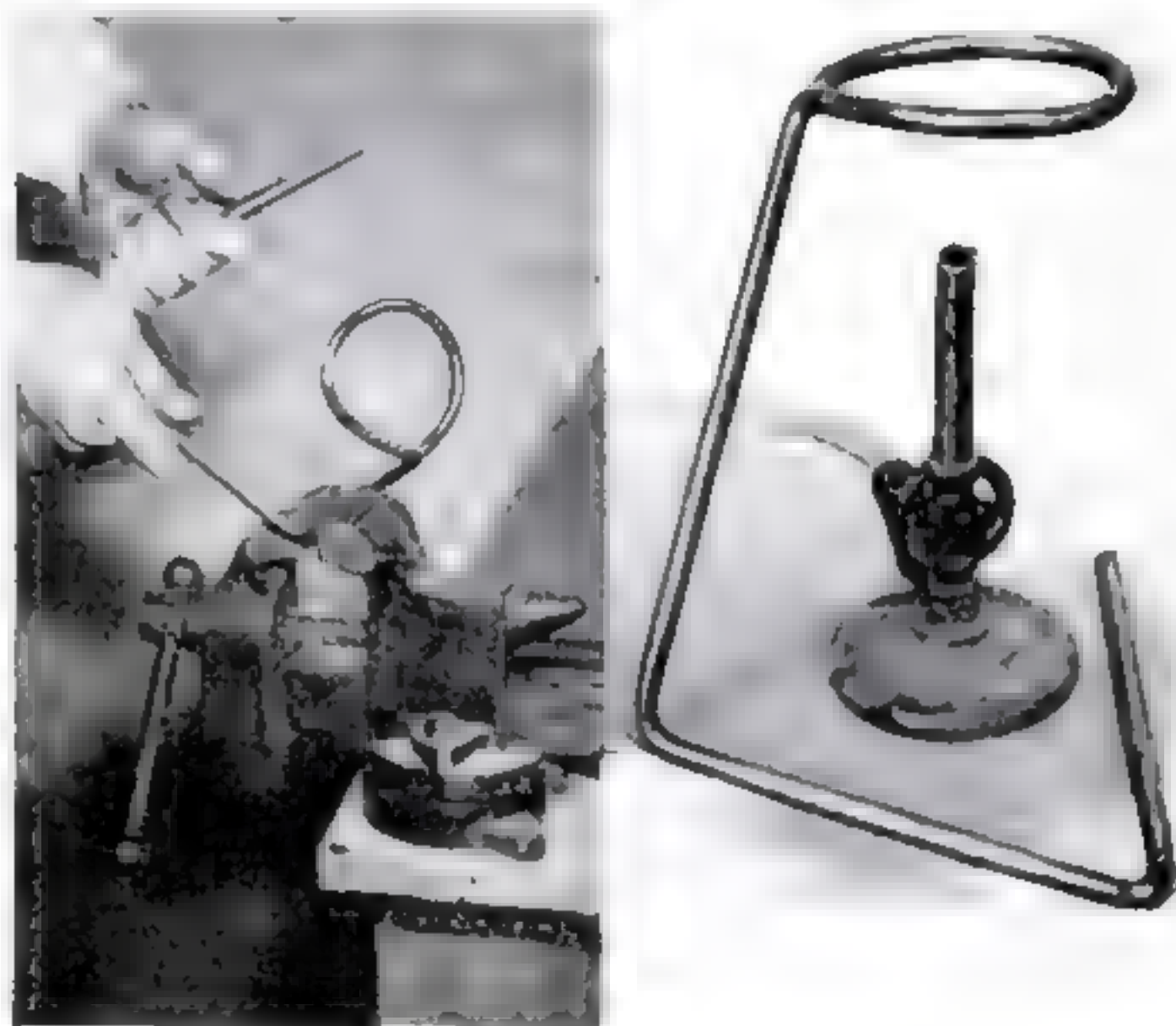


Hack-Saw Tool Prunes Shrubs

A SAW that will fit into the narrowest places when trimming shrubs may be made from part of a hack-saw blade and a piece of broomstick. Slit the wood for about 5" and insert the blade. Bore a hole so a screw may be driven in through the hole in the end of the hack-saw blade. Use two smaller screws or brads to keep the blade in line and wrap with friction tape.—J. L. D.

Steel Rod Bent to Form Bunsen-Burner Stand

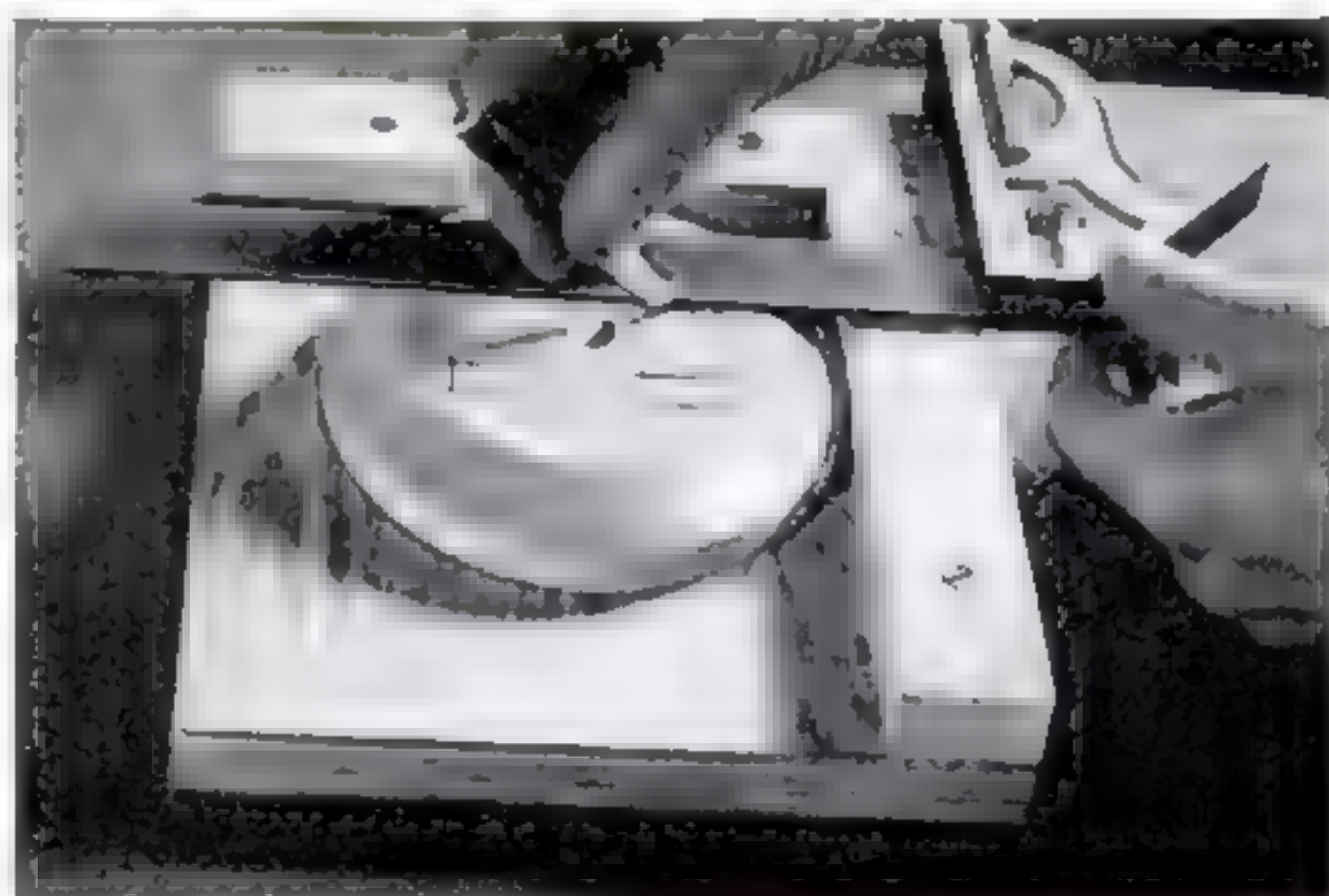
SOLDERING irons, pans, and other utensils can be held over a Bunsen burner by means of the simple type of stand illustrated. From a machine shop obtain a piece of 5/16" cold-rolled round steel rod 3' long. Round off the ends with a file; then, starting at one end, heat the iron red hot and bend it into a ring about 4" in diameter. Make the other bends as shown, locating the ring about 9" above the base.—A. W.



To make the stand, a piece of 5/16" steel rod is heated red hot and bent to shape in a vise

Right-Angle Block Aids in Laying Out Disks

FOR laying out wooden disks or faceplate turnings, the angle block illustrated will be found a great aid. It consists of a square piece of plywood to which two wooden strips are screwed to form a right angle. The work is placed in this angle, and a square is used along the two strips.



Easily made from scrap lumber, this angle block is very useful for laying out lines on turnings

Halloween Habilliments

COSTUME SUGGESTIONS BY HI SIBLEY



FIGURED COTTON

Three-Legged Twins



UNIQUE Hallowe'en costumes of the type illustrated can be made at small outlay for material. The three-legged twins, for instance, require a special coat and shoes, but old pajamas will provide the trouser legs. The perambulating dog house is constructed from a large cardboard carton and painted green with a red roof. Brown "coveralls" and a dog mask should be worn by the person inside.

Jonah's whale is made from pasteboard painted black and varnished. It spouts when ever Jonah, who is clothed in flowing white robes, bears down on the hot-water bottle. The crown of an old felt is sewn inside the body of the whale so it will stay properly centered on the wearer's head.

The over-sized camera is another paste-board contraption, and various imitation photographic accessories can be carried with it. Cut a hole in the back of the camera for ventilation. A small window blind is the only special item required for Tin-Cup Tommy. An unlimited variety of other costumes can be worked out in the same way.

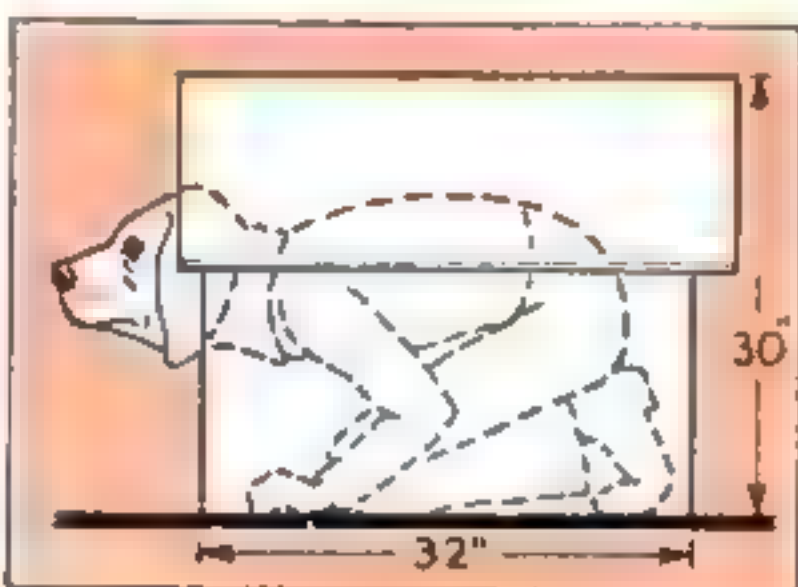
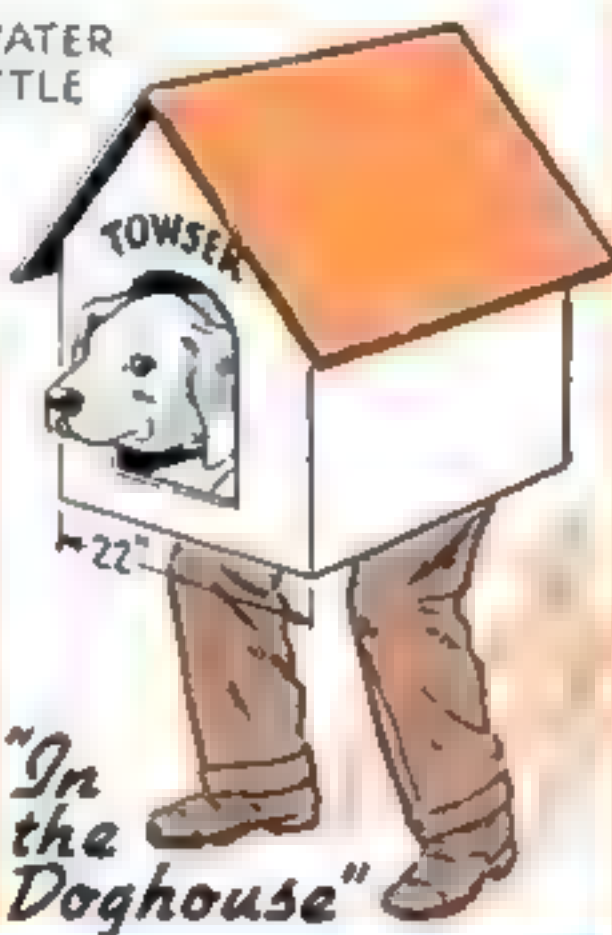
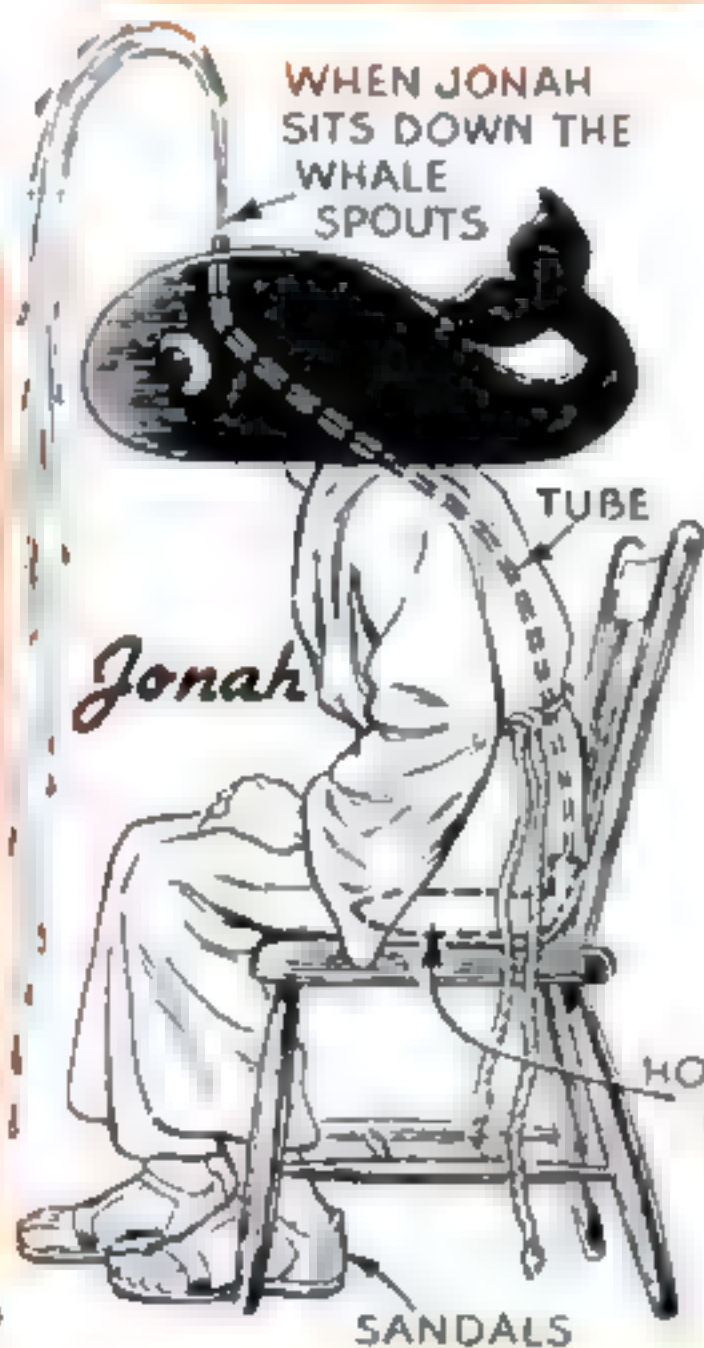
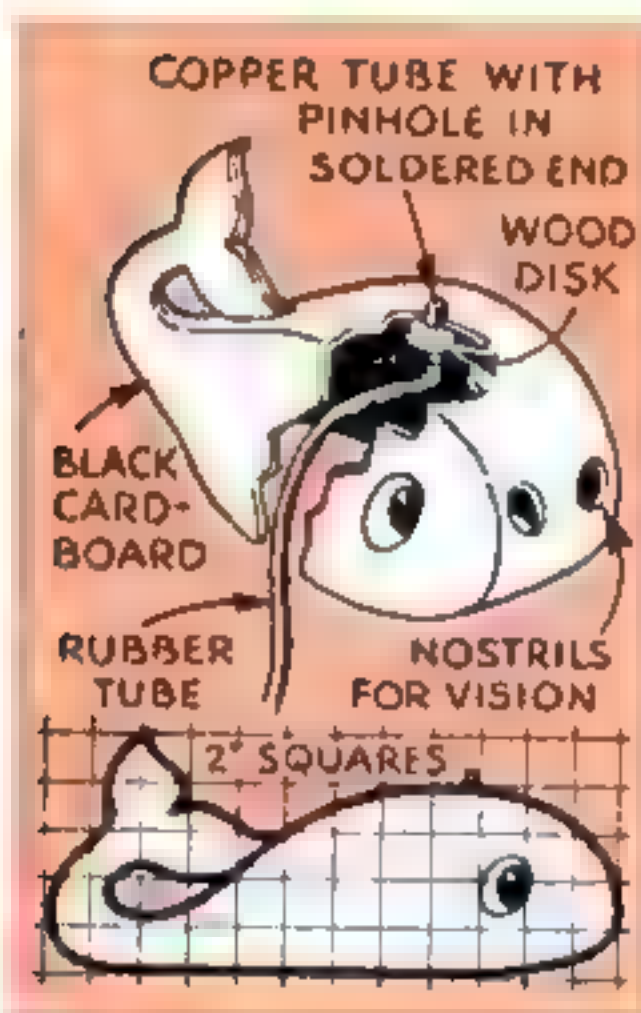
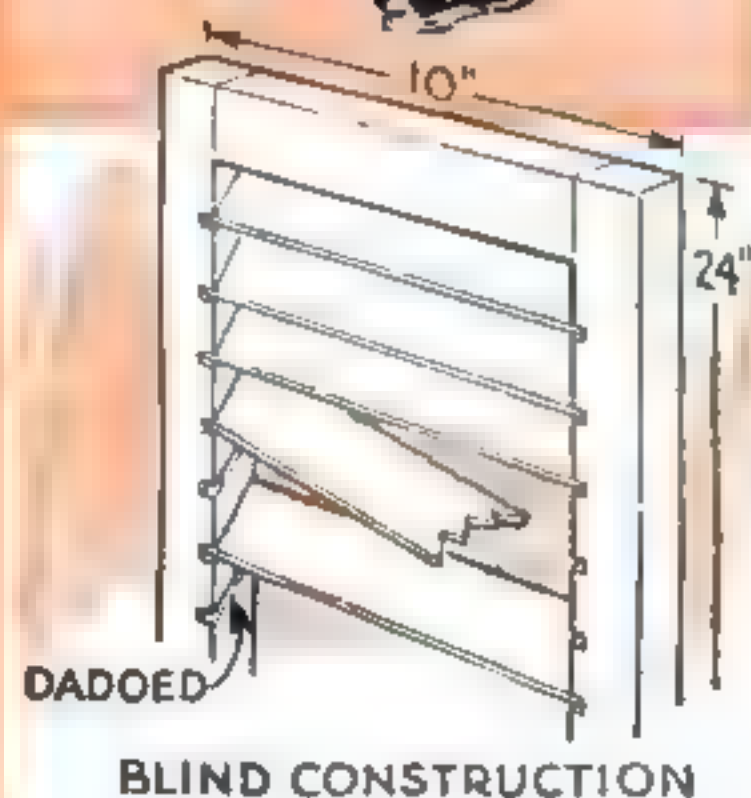
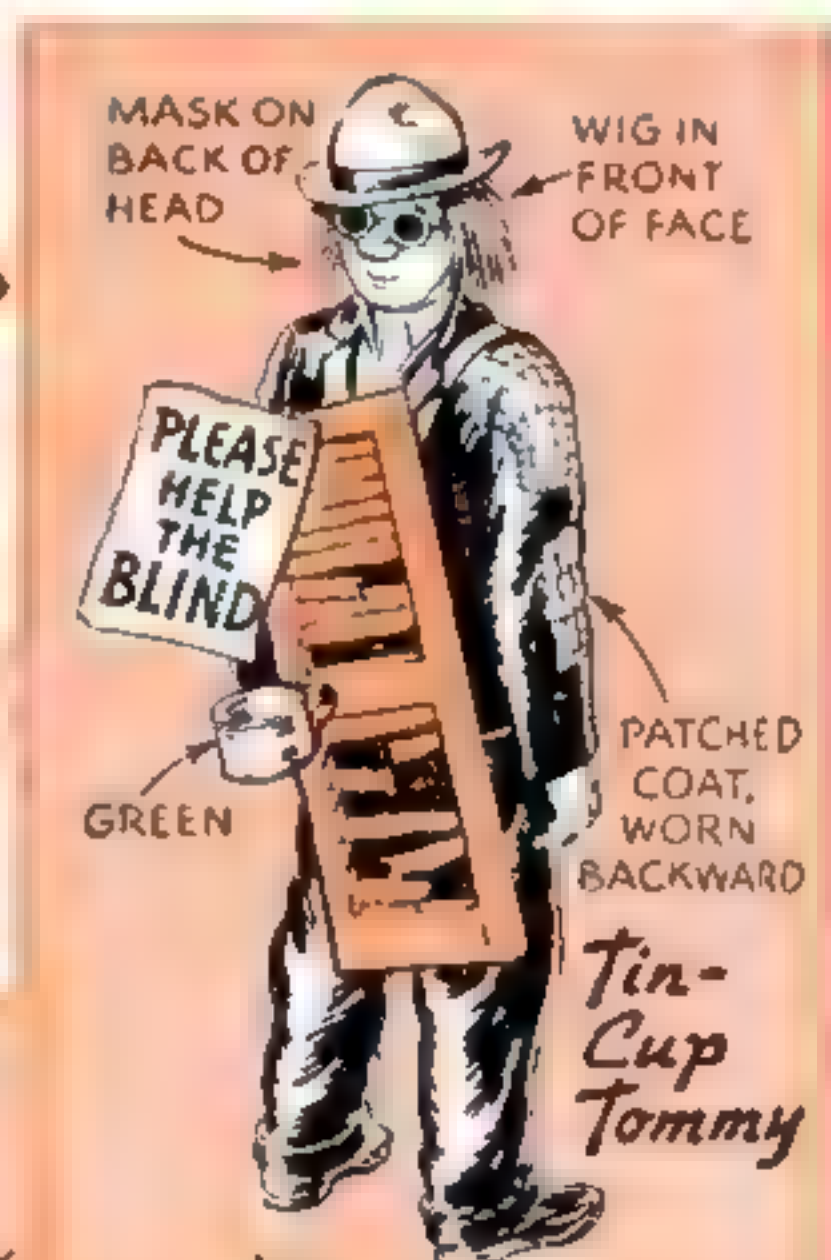
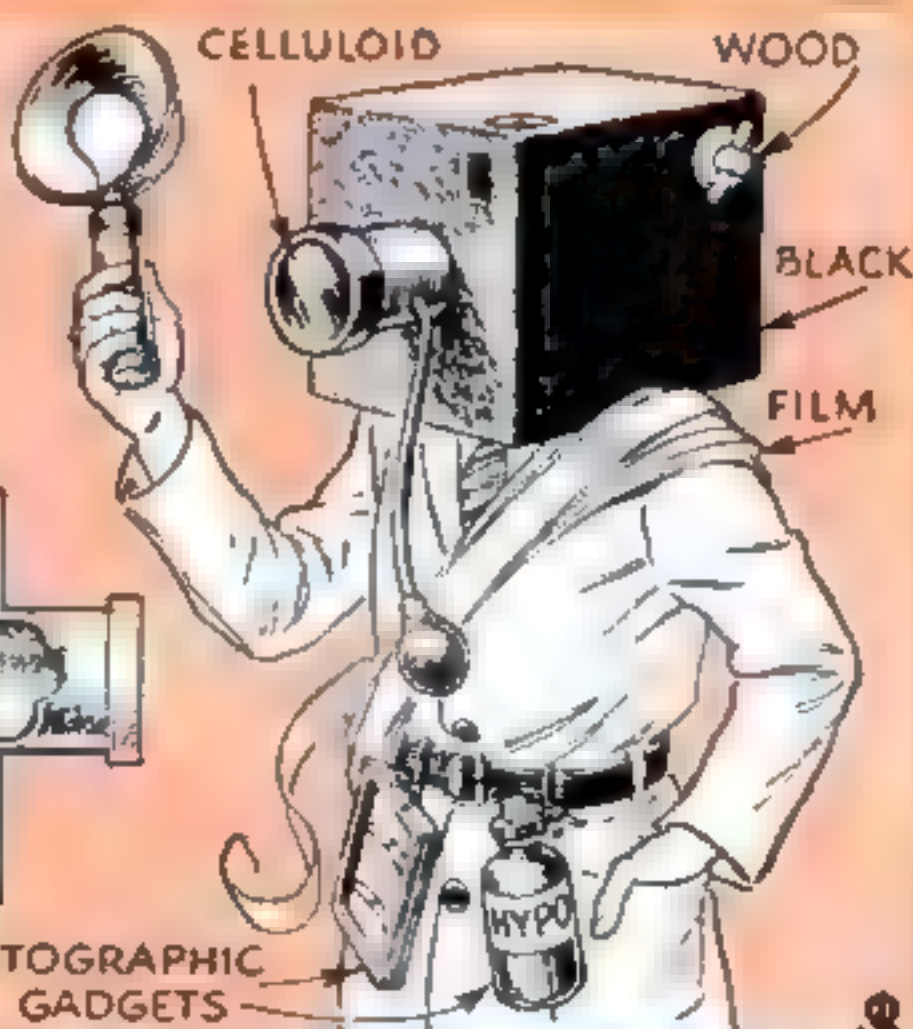
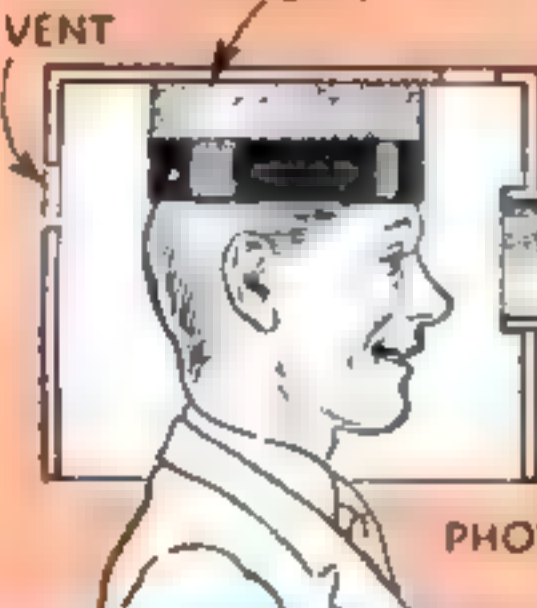


Photo Pete

STRAW-HAT CROWN RIVETED TO CARDBOARD CAMERA





While one man keeps a continual snub on the stage lines, the crew hauls up the back-row scenery

Stage Rigging Methods

FOR AMATEUR THEATRICALS

AMATEUR theatrical performances are often marred by exasperating waits between acts while the scenery is being shifted. There is no reason for such delays. The successful handling of scenery depends upon teamwork among the stage crew and skill in manipulating the sets. Methods described in this article have been used by the Montclair (N.J.) Operetta Club and Montclair Dramatic Club.

Most amateur groups perform on a school stage which is usually poorly designed for play production. Lay out the scenery to scale on a floor plan drawing of the stage; make sure that it fits and that all "holes" are masked in. Give considerable thought as to how the shifting is to be handled and where the scenery is to be stacked when not in use.

The scenery should always be marked for identification. Paint the marking on the wood. When the scenery is moved to the stage, make a trial set-up of each act and mark key locations on the floor with colored thumb tacks—red for Act I, white for Act II, and so on.

Upright scenery is lashed together and supported with stage braces, which are made fast with special screws placed in the cracks between the floor boards. The flats themselves seldom have to be anchored to the floor. A small wedge under one corner of an off-square flat will make it sit firmly.

When a row of flats is to be hoisted or flown, it is desirable to fasten them together with wooden cleats in addition to the lashings. The cleats should be as long as the row. They keep the flats in line if the hoisting batten should spring a little. Even when suspended from above, the flats should always be supported by stage braces when in place, otherwise the slightest draft will make them sway.

When planning to fly scenery, always be suspicious of the strength of the usual school rigging with the eyes carrying the pulleys set in a plastered ceiling. Consult the architect of the building if doubtful. If you are lucky enough to have an open grid with movable blocks, your troubles are at a minimum. Examine the hoisting lines for bad

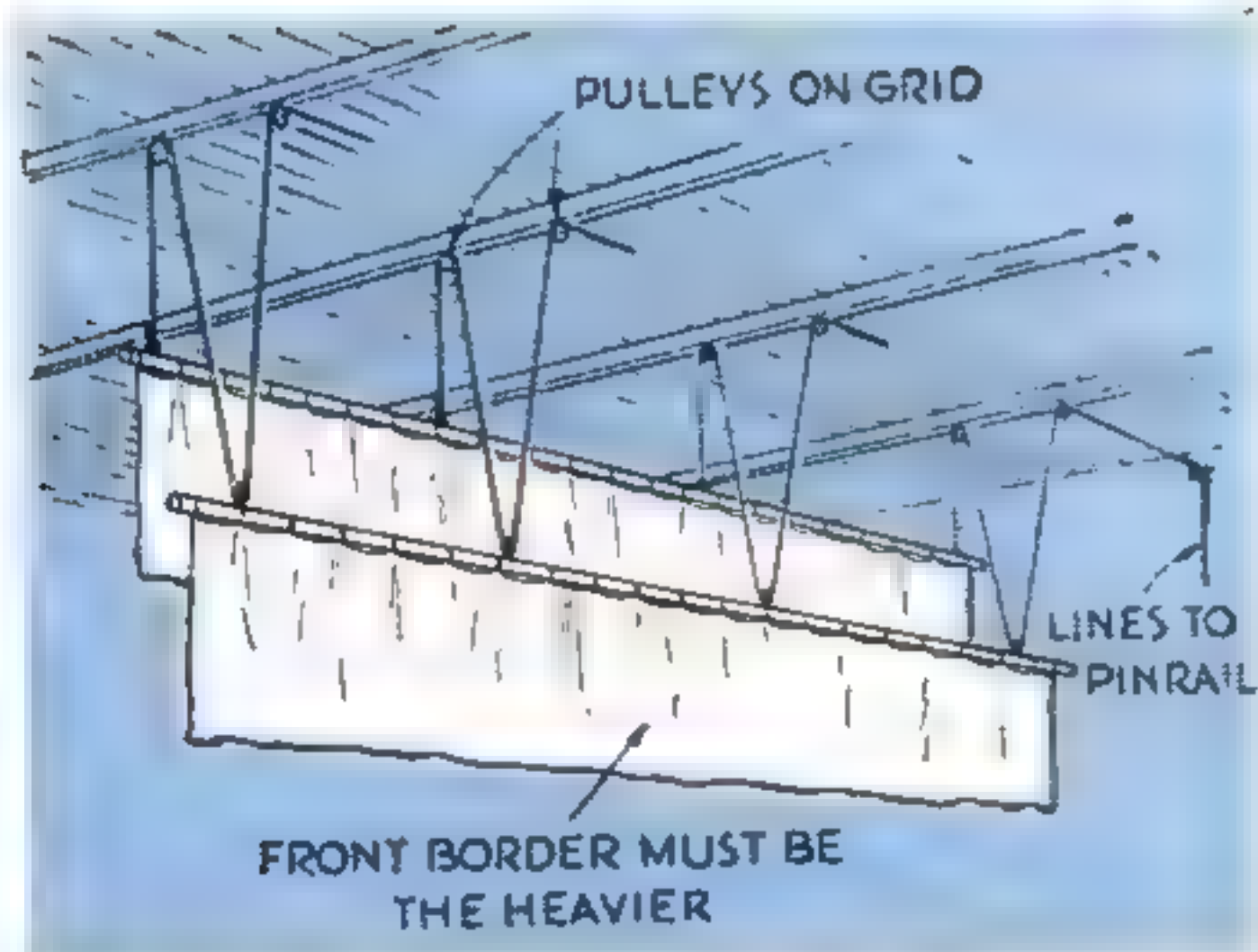
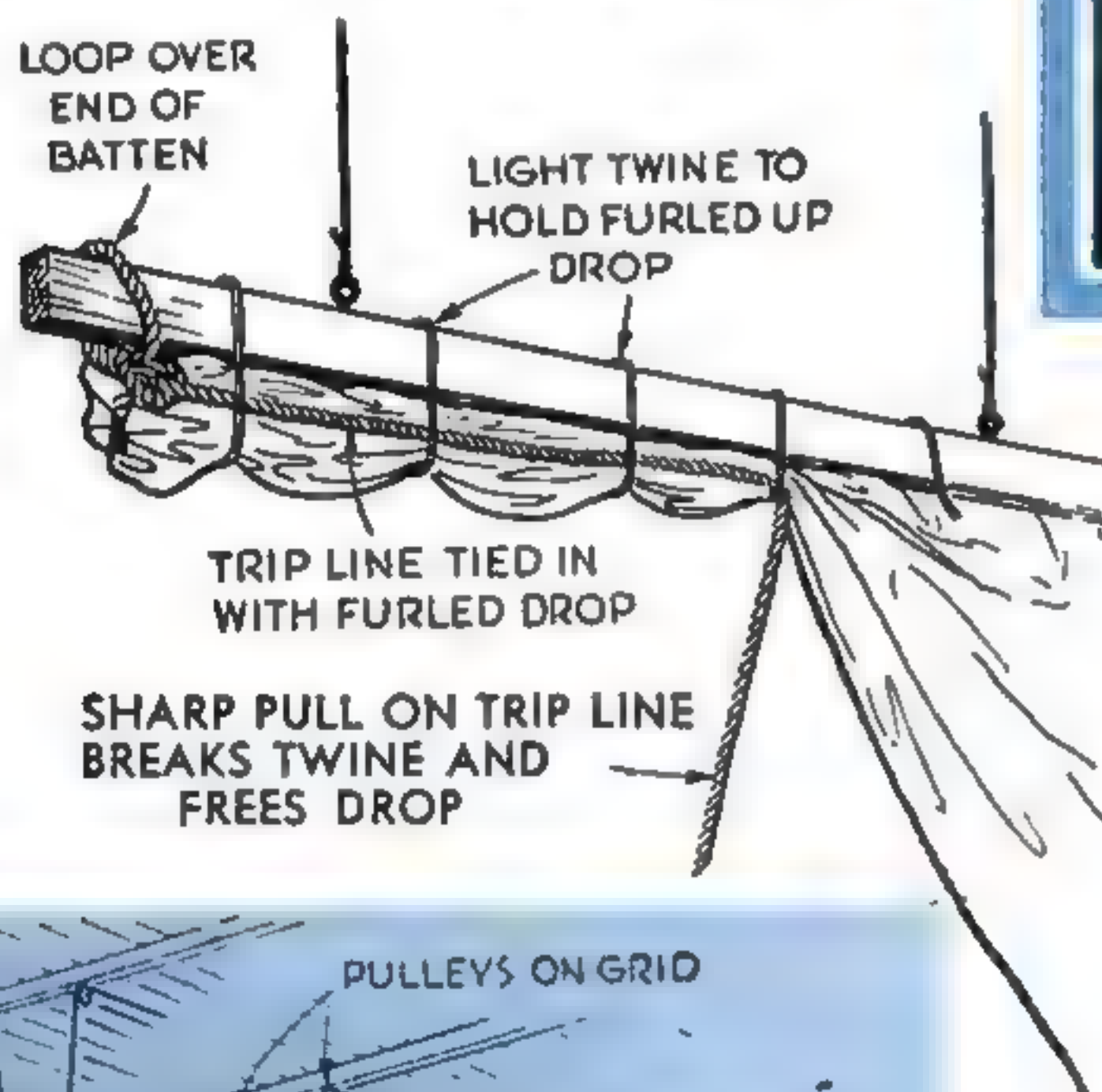
By THOMAS L. HALL

spots and be sure they are strong enough for the job. The safe load for good $\frac{1}{2}$ " manila rope is about 100 lb. for flying scenery.

In spite of its weight, $1\frac{1}{4}$ " or $1\frac{1}{2}$ " pipe is about the best material for scenery battens. For very light work, however, $\frac{3}{4}$ " pipe or even wood may be used. Battens should always be tied to their supporting lines so that the lines hang vertical, otherwise the batten will get out of level when hoisted.

Rope, particularly when new, will stretch, and the battens must always be leveled when fully loaded. Measure the height of the batten from the stage and adjust one line at a time until level. When finally leveled, mouse all the hoisting lines together at the pin rail with twine or friction tape. This mousing, if put on opposite some fixed mark when the batten is at its proper height, will serve as a marker for setting the batten during the performance.

Cloth borders, to mask the stage overhead, are used in practically every show. If they must be changed between acts, hang two borders on one batten with the Act 2 border in front. For Act 1 furl up the Act 2 border



Two ways of rigging borders. The lower method is more complicated and needs a grid above the stage



When plenty of man power is available, a watch tackle is more adaptable than counterweights. Grooved blocks bolted between steel plates form a rope clamp

like a sail and let it drape over the back of the batten. The lines will keep it from falling down. It can then be easily tripped down with a long pole between the acts. Obviously, the Act 2 border must be wider than that used for Act 1. Another method, that of setting up a border in stops, and also a more complicated rigging using balanced battens are shown in the drawings at the left. These schemes are used for very fast shifts.

Back drops are suspended from battens and should always have a piece of pipe run through the bottom hem to pull out the wrinkles. The drop is hung with the pipe just clear of the floor. When possible, set only one drop to a batten and don't furl them if there is enough room overhead to take them up standing. If they must be furled, lower the batten to the floor and tie the whole thing, including the foot pipe, in-

to a bundle with a number of rope slings.

If a large drop or a cyclorama (curtain encircling the entire stage) is hung close to the rear wall, the difference in temperature between the wall and the air on the stage will be sufficient to cause a strong draft to flow back of the drop and make it belly out at the bottom. In some cases a wood cleat must be nailed along the entire length of the drop to secure it to the floor and the hoisting lines pulled very tight to get rid of the belly. To change drops when the bottoms of both are nailed fast, each drop must have its own batten. Use one set of hoisting lines. Lower the drop to be changed to the floor, untie the batten, transfer the lines to the other batten and take it up. There must be some kind of ground row in front of the drops to mask the one which is on the floor.

A method of rigging a cyclorama and other rigging stunts are shown in the accompanying drawings. Rigid scenery should be attached to the battens with light chain. Fly as little of it as possible.

Stage lines normally terminate on a pin-rail at floor level on one side of the stage where they are "tied off." Since most stages available to amateurs do not include counterweighted lines, the lifting of heavy scenery is something of a problem. Homemade counterweights are hazardous unless carefully rigged. The cast-lead weight shown in a drawing is about the best available for amateur work. To the best of the author's knowledge, it was originated by the Montclair (N. J.) Dramatic Club. The watch tackle shown in the photograph is more adaptable than counterweights, especially

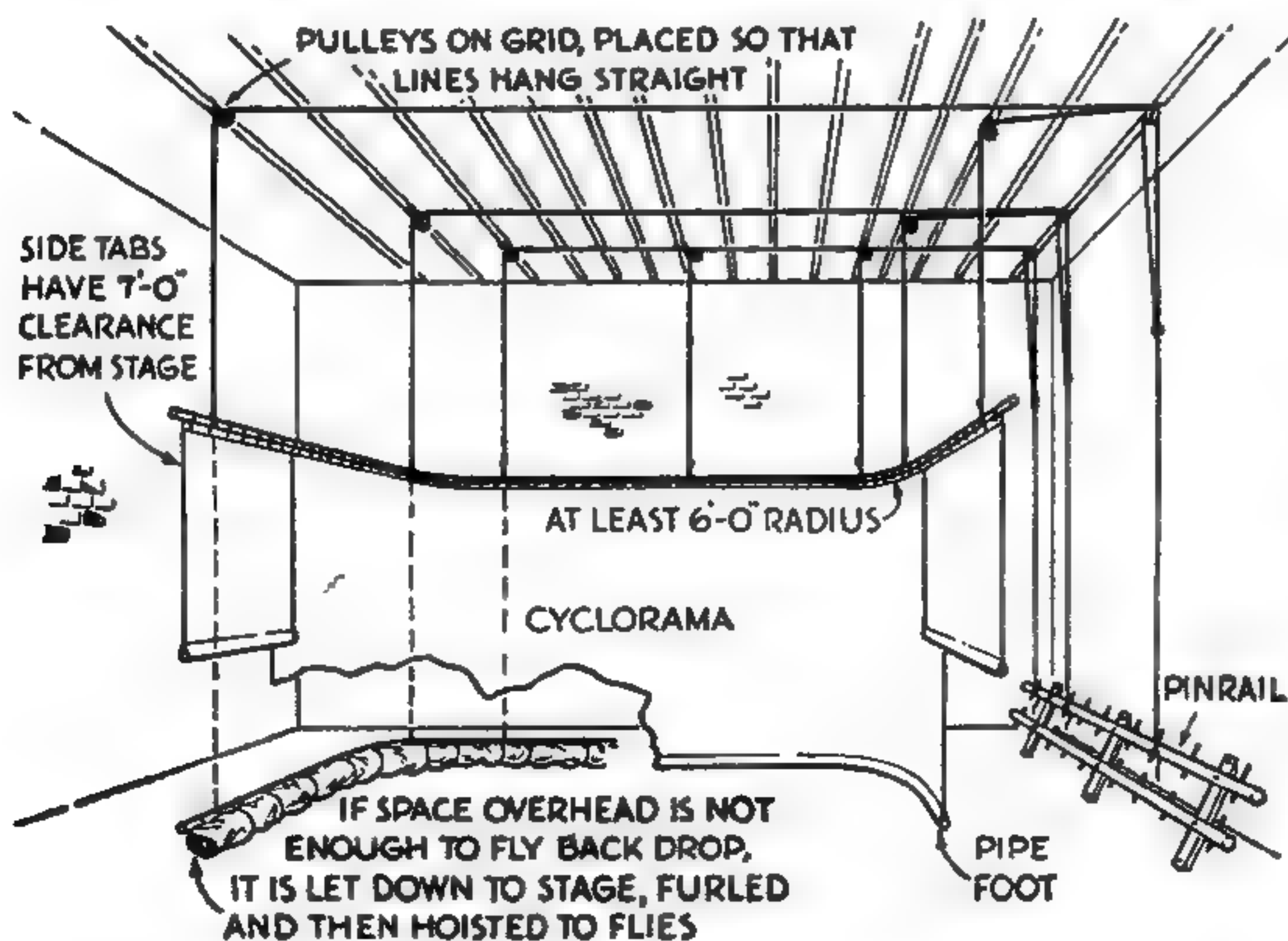
when plenty of man power is available. Another photograph shows the method of hoisting with the tackle. One man keeps a continual snub on the stage lines and acts as straw boss of the group. The rope clamp is especially helpful. It is simply two blocks of hardwood grooved somewhat smaller than the ropes and bolted between two steel plates. If no rope clamps are available, the tackle or counterweight may be made fast to the stage lines with a rolling hitch.

A knowledge of knots is indispensable in stage rigging. At least one member of the crew should be able to splice rope, and the ability to make a running splice which will pass through a pulley will sometimes save a performance from disaster.

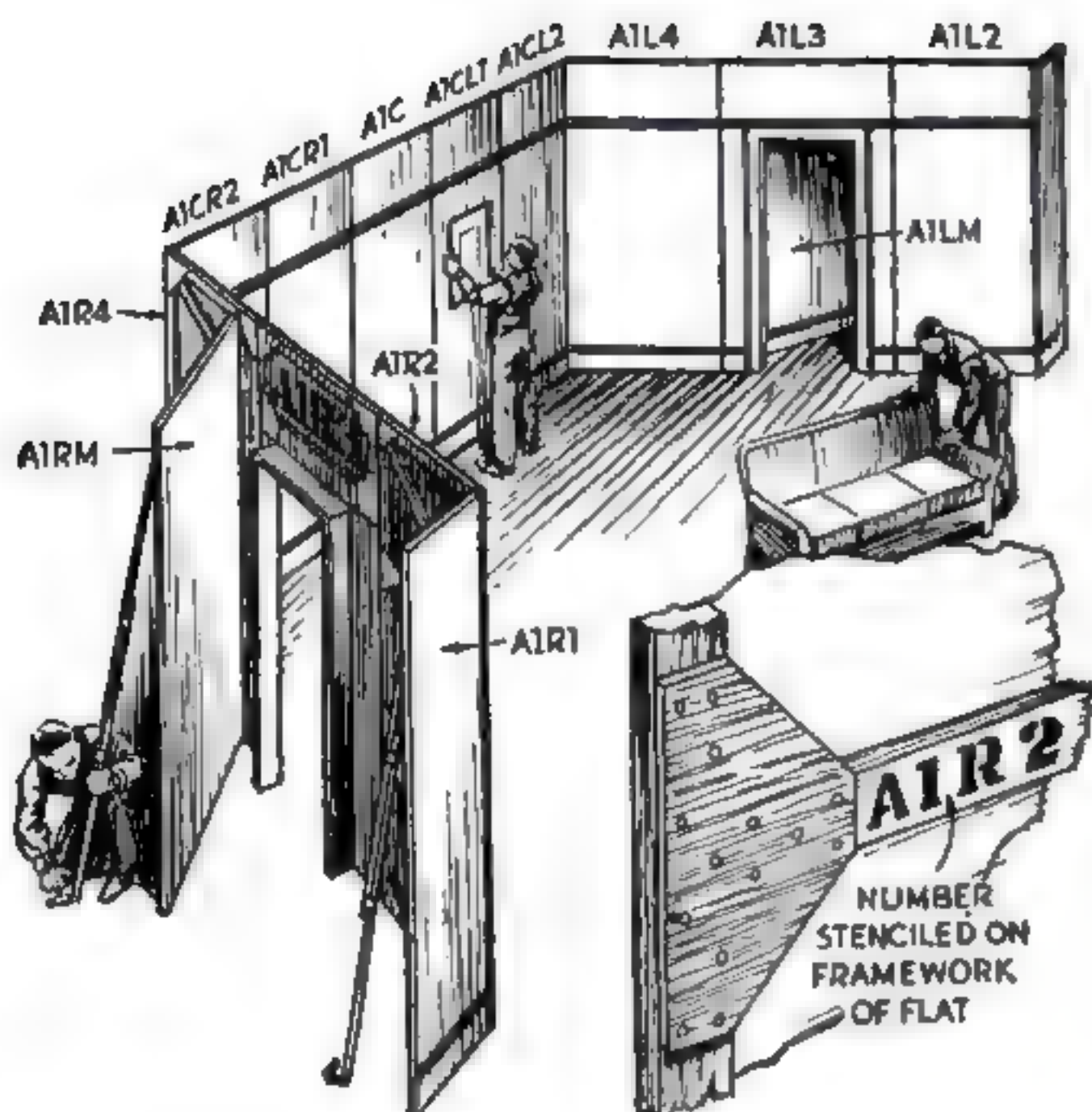
The stage crew should have a complete tool box handy and there should be a long stage brace with the top and bottom irons



Lead counterweight made by pouring 95 pounds of molten metal into a can. Remove the tin when cold



Counterweight rigged with downhaul. Left, elaborate rigging for three-piece cyclorama



Scenery should be clearly marked for easy identification. For instance, AIR2 means Act I, stage right, second from footlights

removed to be used as a measuring stick, for tripping borders, and guiding up scenery. A long step ladder is also very useful.

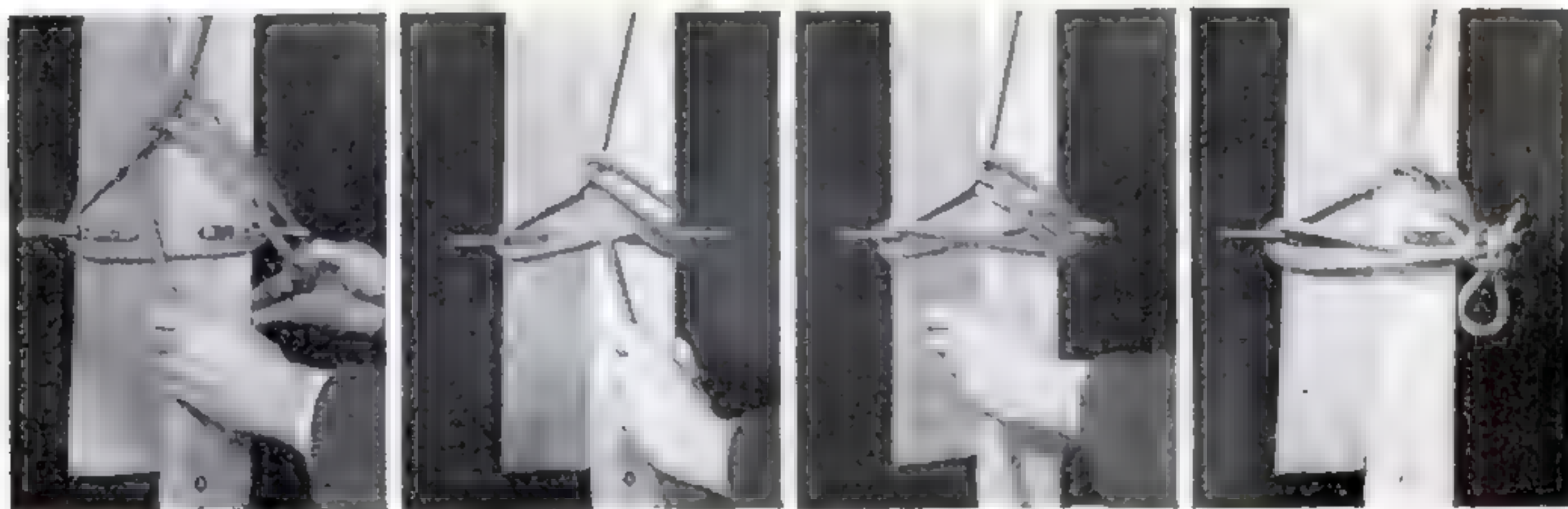
Since life insurance companies regard professional stage work as a fairly hazardous occupation, a few safety suggestions are not out of order:

Keep the cast off-stage during shifts. Examine knots, line, and any weight-carrying parts before each performance. Beware of snap hooks and screw eyes in tension. Never stand under counterweights nor under scenery being hoisted. When working aloft, always tie your tools fast.

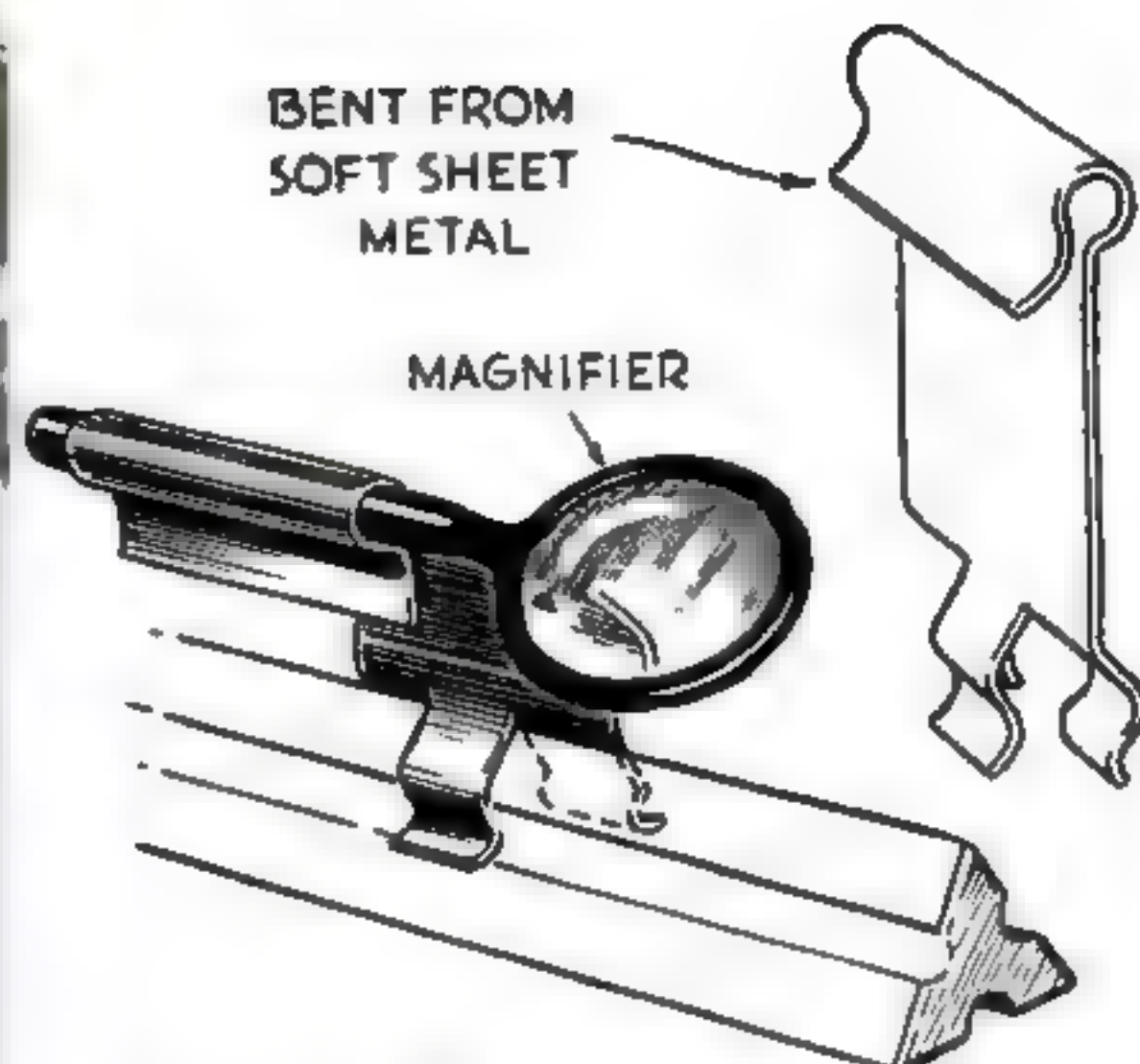
If you drop something yell "headache" as loud as you can. "Look out below" takes too long to say. Always steady a ladder. Don't force a line which suddenly pulls tight.



Never seen and rarely heard of, an efficient stage crew may well be called a hidden but invaluable asset to any dramatic organization. They receive no applause and scant credit from the cast. Their entire reward lies in the personal satisfaction which follows when their work is a success because it was well planned and well executed.



Four steps in tying off a line to lash flats together. Use a square knot for joining two ropes; bowline-on-a-bite, loop in doubled rope; bowline, loop in single rope; reef knot, tying on back drops and borders; anchor knot, tying on batten lines; and a clove hitch for general purposes

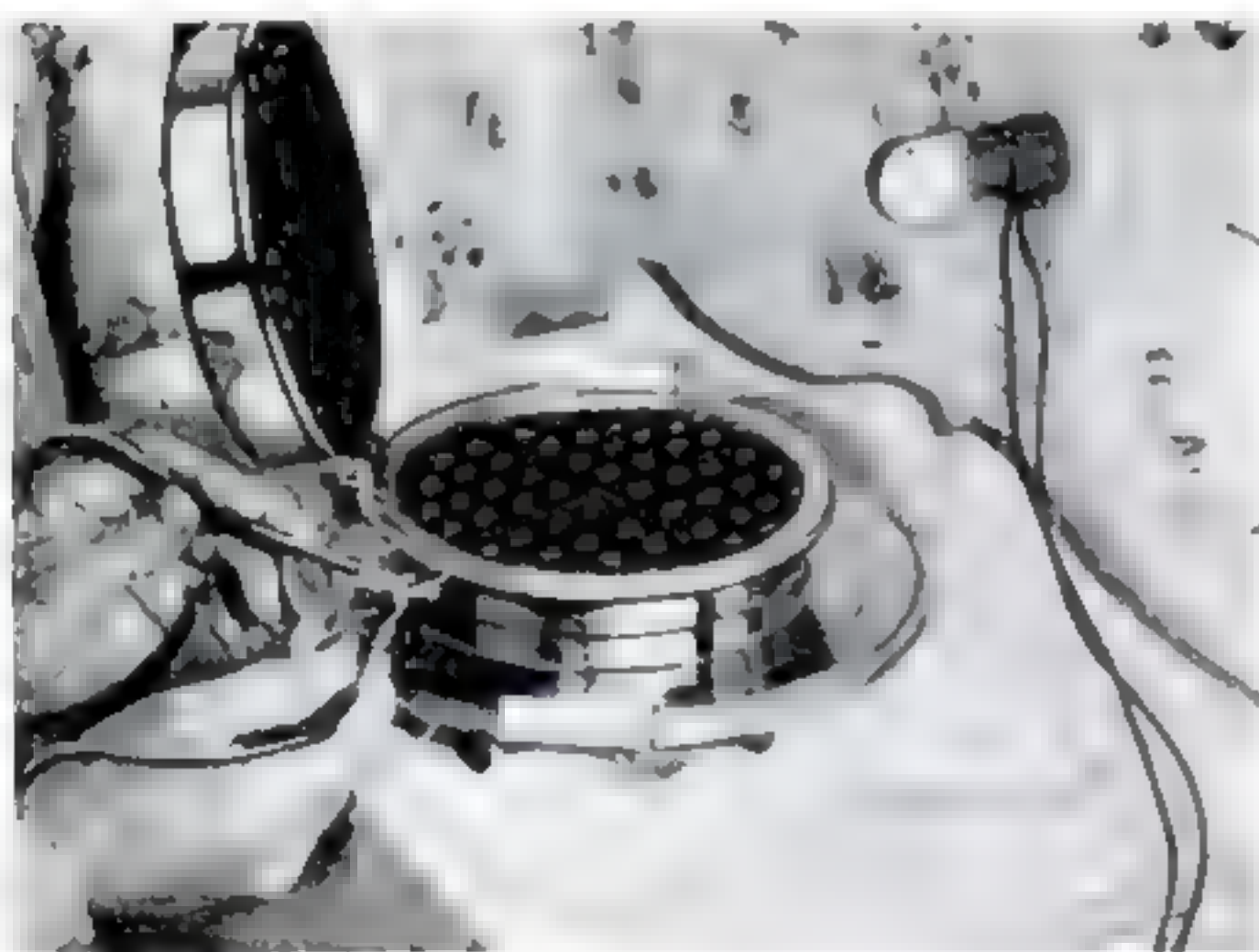


Cut from soft sheet metal, the holder clamps to the architect's triangular rule, as above, and can be bent to any position. At left, the device in use

Magnifier Attached to Scale for Fine Readings

IN USING the very fine graduations on an architect's or engineer's triangular scale, you will find it helps to attach a small magnifying glass to it as shown. The holder

is constructed from soft sheet metal, and the magnifying glass is adjusted to the most convenient position merely by bending the support.—M. G. WINTERTON.

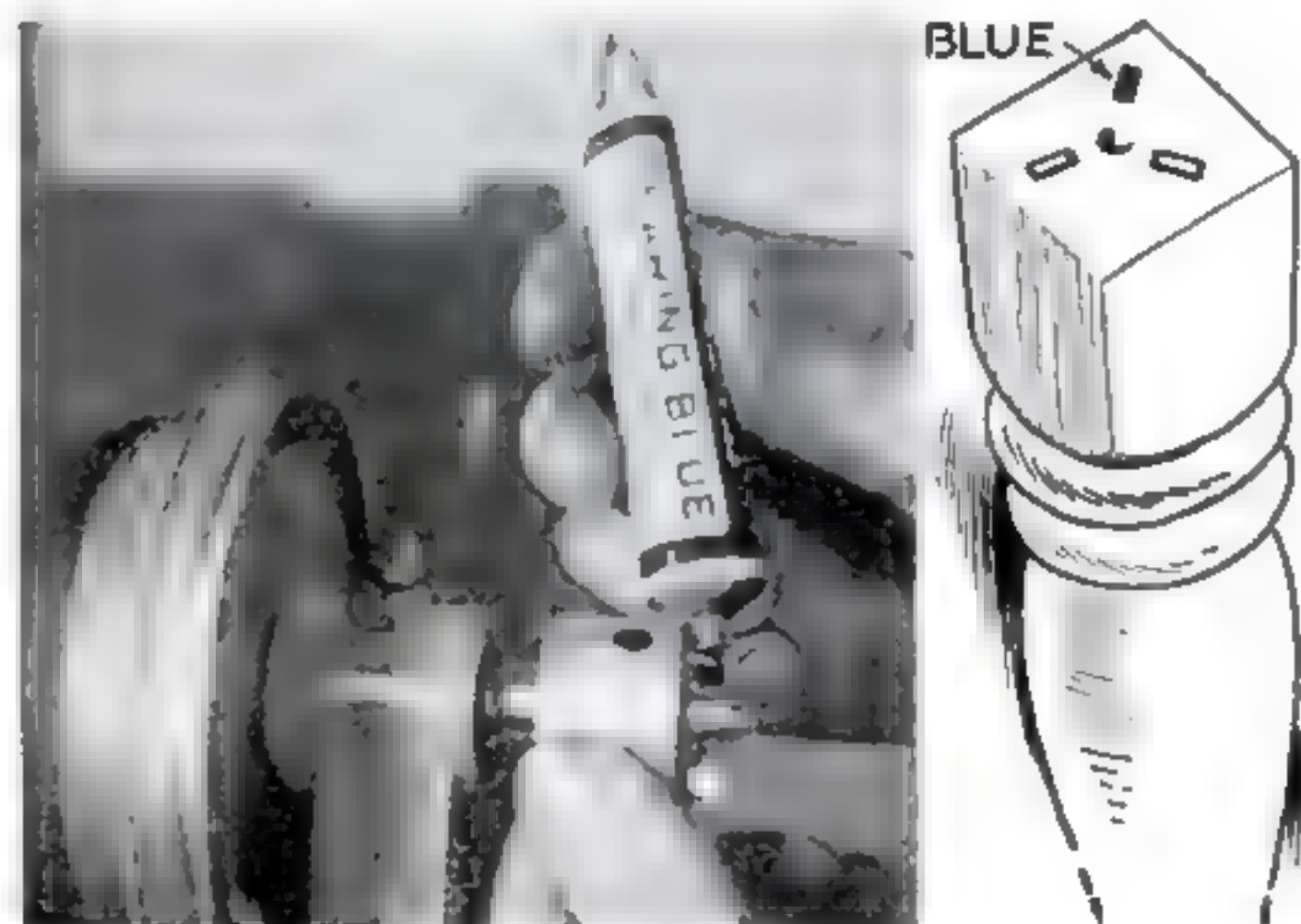


Wood-Turning Spur Center Marked with Blue

WHEN an unfinished spindle turning has to be removed from the lathe, it is important to mark it so that it can be replaced later with the spurs of the center in the same position they originally occupied, otherwise any slight variations in the spurs might cause inaccuracies. A simple way to accomplish this is to put a spot of black enamel on the body of the center adjacent to one of the spurs and thereafter keep this particular spur coated with Prussian or bearing blue. When the spur center is driven into the end of the wood to be turned, the blue pigment will leave a mark.

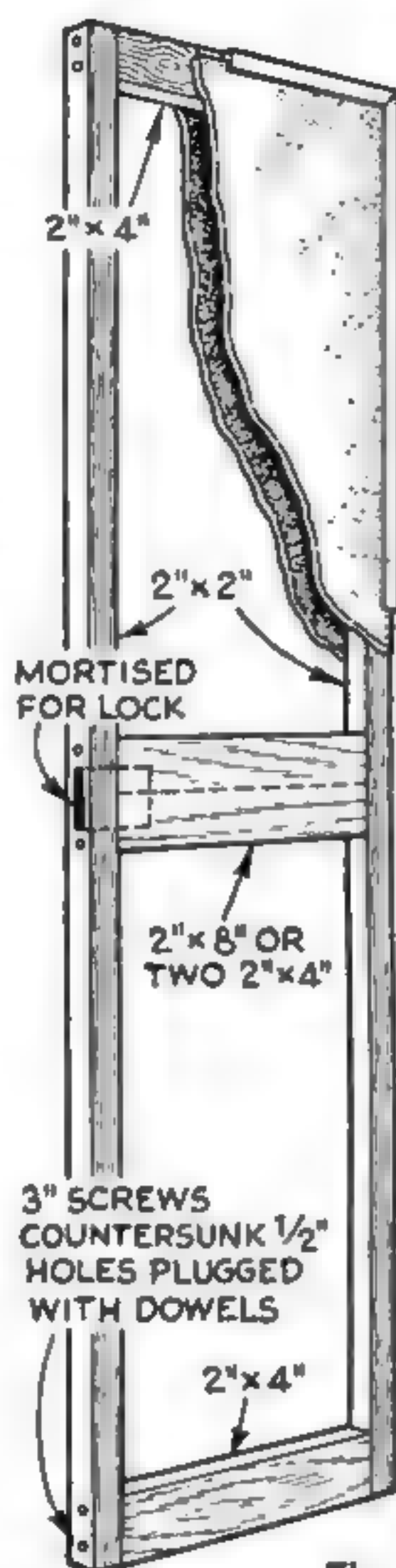
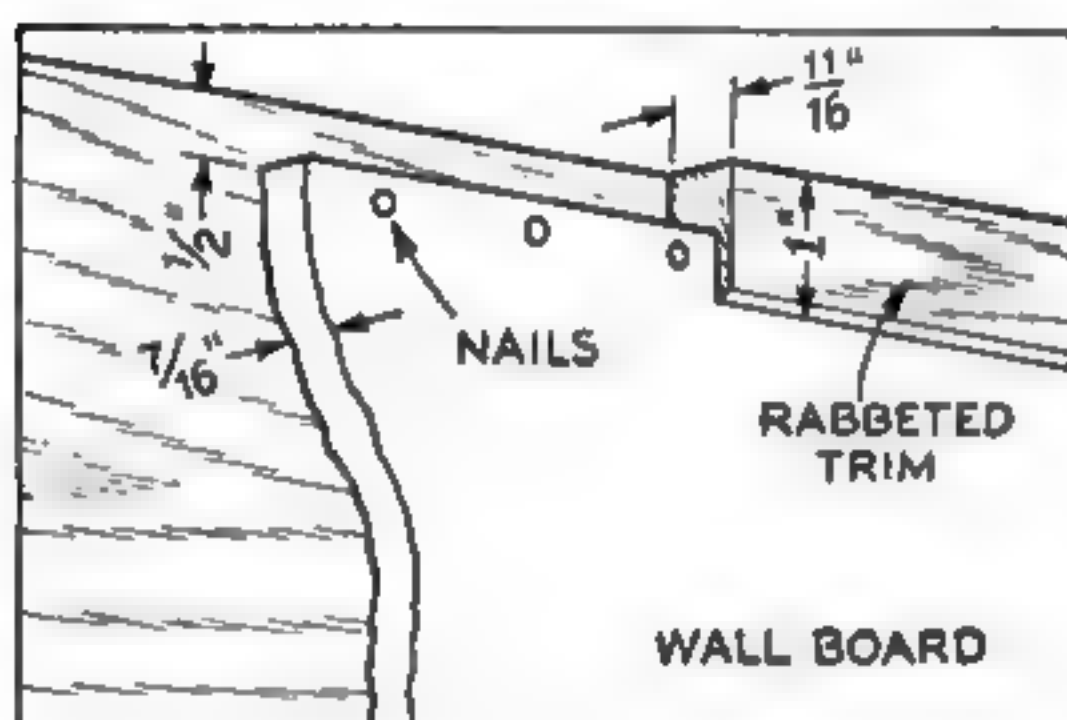
Convenient Circuit Tester Made from Night Light

A SMALL, shaded night light of the plug-in type can be converted into a tester for electric appliances as illustrated above by removing the switch mechanism and soldering two leads about 36" long to the contacts. The leads are inserted through the switch opening and knotted on the inside. Test prods can be obtained from a radio supply house or made from two pieces of bus bar wire 4" long. These are soldered to the ends of the leads and covered with spaghetti tubing so as to leave about $\frac{1}{2}$ " of the tip bare. The tip should be ground to a needle point.



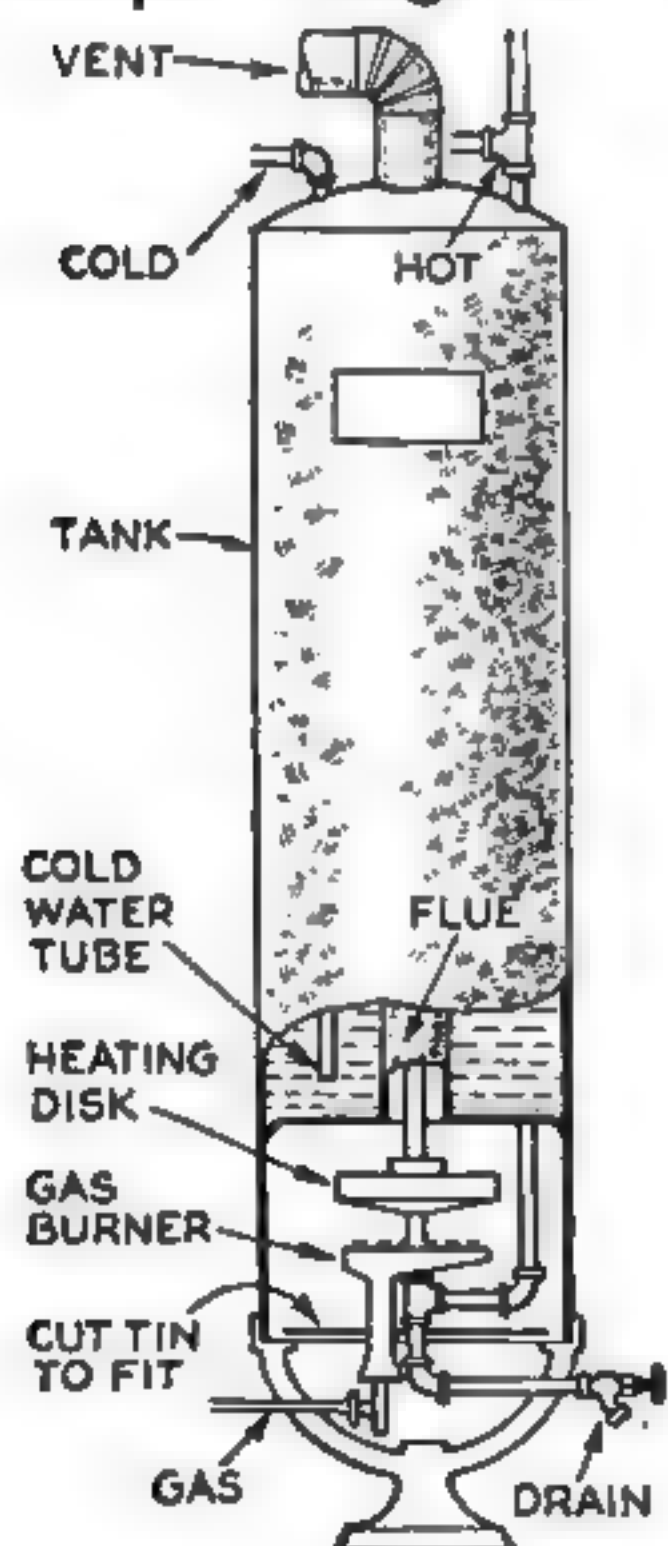
Modern Doors of Wall Board for Use in Cottages

INEXPENSIVE but modern-looking doors for use in cottages, attic rooms, and similar places, may be made by covering frames of common lumber with wall board as illustrated at the right. The wall board is cut $\frac{1}{2}$ " smaller than the frame all around, and is fastened with nails $1\frac{1}{2}$ " apart. The nailheads are then concealed by applying the rabbeted trim with 1" brads. The opposite sides of a door may be covered with wall boards of different textures to match the wall finishes of the rooms they are to face. Employing common lumberyard materials, these doors can readily be constructed in a fraction of the time it takes to make doors of the conventional mortise-and-tenon type.—J. MODROCH.



The wall board is cut $\frac{1}{2}$ " smaller than the frame and nailed to it. The nailheads are concealed by the trim

Improving an Old-Style Water Heater



OLD-STYLE combination gas water heaters of the type illustrated at the left sometimes take a long time to heat up. This may be due to the considerable loss of heat through the open lower end and can be corrected by cutting a sheet of old tin or galvanized iron to fit in the bottom where indicated. It should fit rather loosely because enough air must still pass around it to insure perfect combustion.

Besides preventing the escape of heat, the tin reduces the speed with which the exhaust gases pass up the flue so that more heat is absorbed by the water. In one case it was found that only about half the time was required to heat a tankful of hot water.—HAROLD W. BOHMKE.

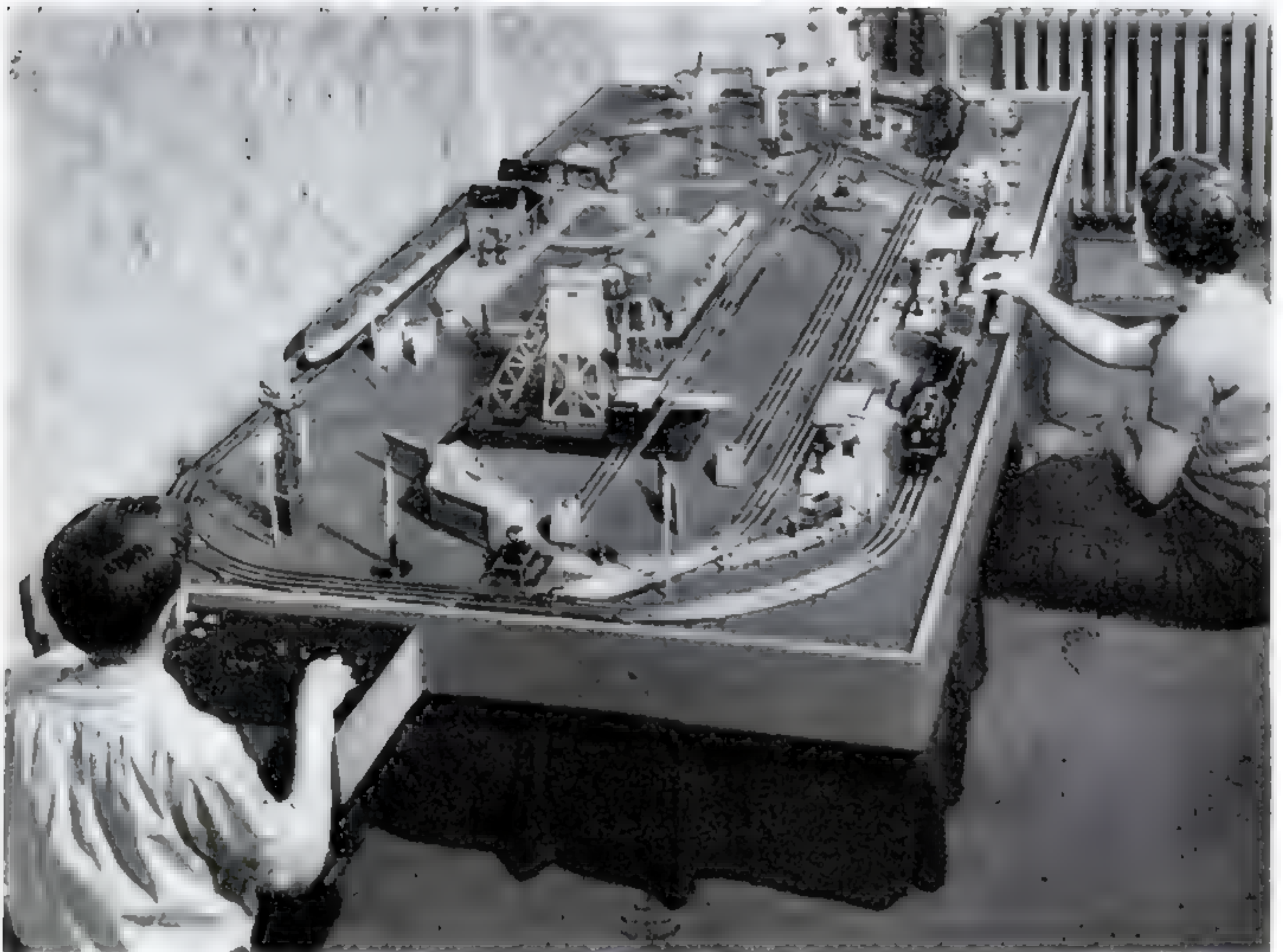


Boiling Milk Renews Cracked Dishes

IF NEWLY cracked dishes are boiled in raw skim milk, their life may be materially extended. Dishes so treated will be found to have lost their cracked sound when rapped with the knuckle. They will last almost as well as dishes that have never been cracked.

Model-Railway

PROVIDES WIDE RANGE



The layout has a main line, branch line, and two sidings, with separate controls for several trains

By C. ELMER BLACK

HERE is an effective model-railway layout that enables two or three trains to run at the same time, each being separately controlled. When desired, two persons can operate the system together, each controlling one of the sections. If distant-control equipment and O-gauge track is used, as illustrated, the arrangement will fit a platform as small as $4\frac{1}{2}'$ by $10'$.

Place the control units, such as the rheostats and whistle controller, on a panel at one end of the platform. At the points marked A, it will be necessary to insert short pieces of straight track to avoid distorting the entire layout. Place the insulating pins, which separate the circuits, as

indicated; and where connections are made to the track, solder the wire to the underside of the rail. On the 45-deg. crossover, where the main and branch lines intersect, wrap tire tape around one of the two center-rail connector strips where they cross under the insulating block to keep the circuits separated. No insulating pins are shown in the outside rails of the switches as the various models differ, and reference should be made to the manufacturer's instructions.

Separate current is supplied to the switches for efficient operation, and a single-pole, double-throw switch, of either the knife or toggle type, enables higher voltage to be fed the system when operating several trains. Although not shown, three wires run from the contacts on the switch to the lever control in the usual manner.

After the wiring is complete, if the lamps

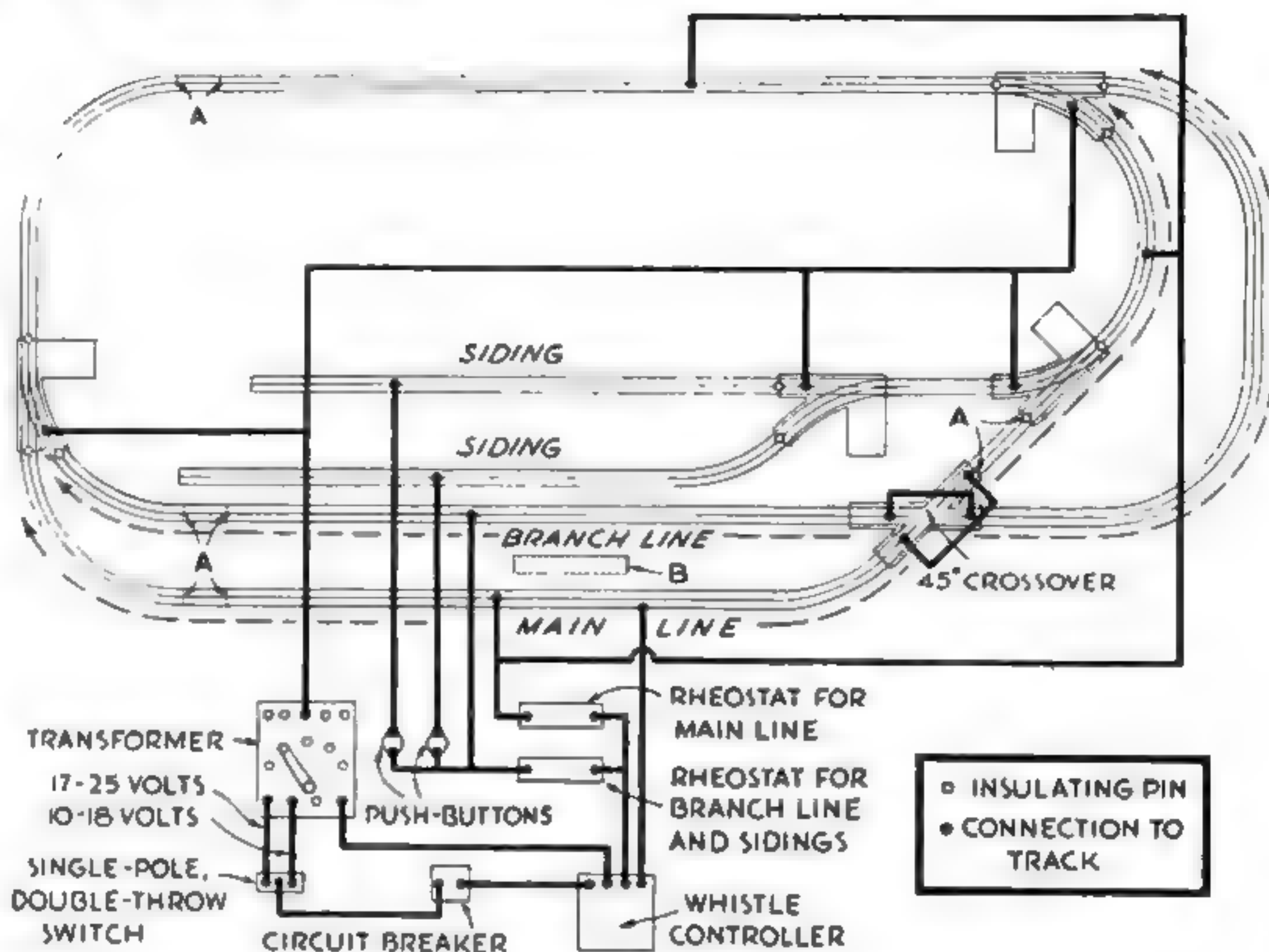
Track Layout

OF OPERATION

in the switches glow faintly or do not light at all, reverse the wires on the outside of the whistle controller. Train speeds are controlled by the rheostats, and on the sidings push buttons of the door-bell style are pressed down to move the trains.

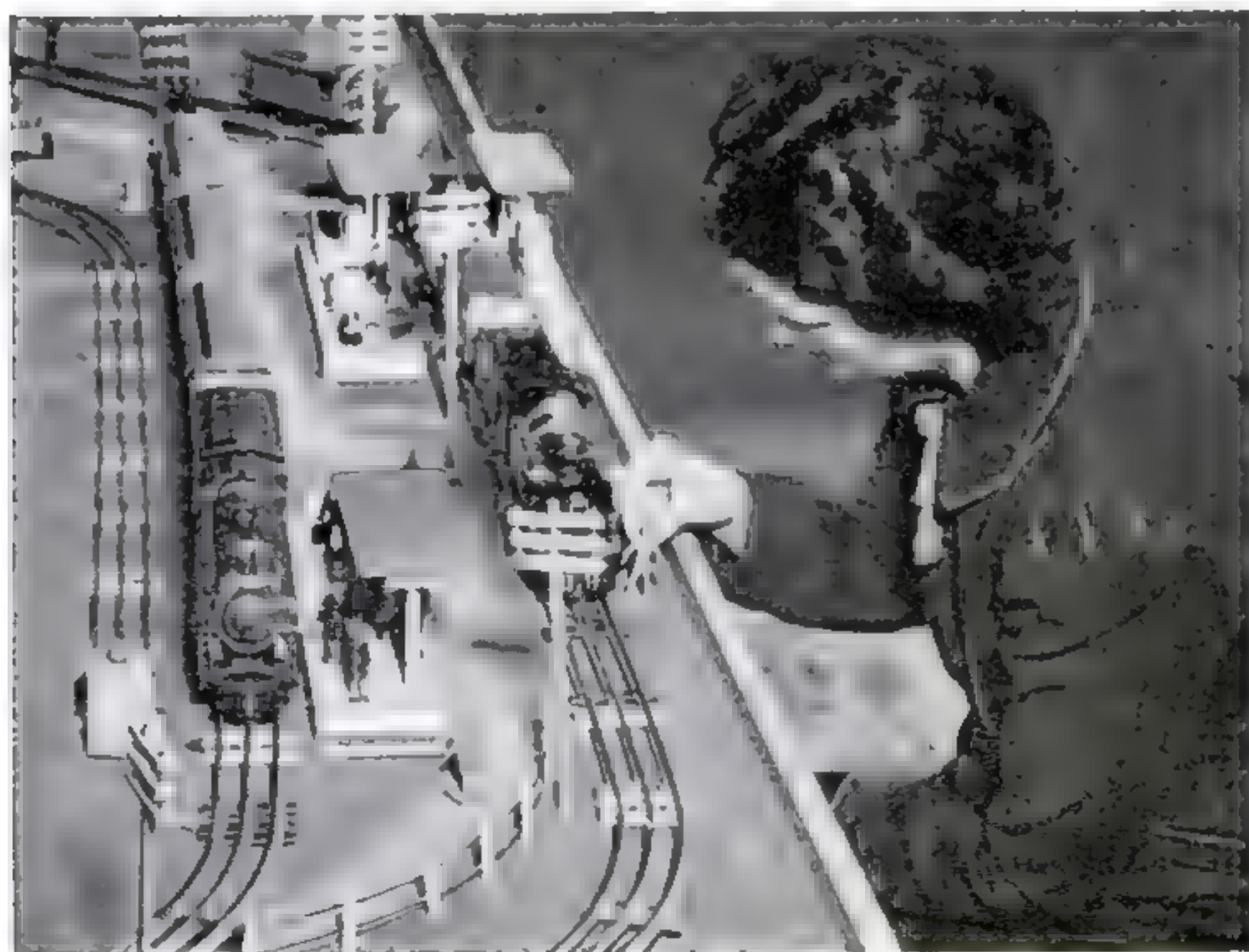
As only one transformer is used, it should have a capacity of about 150 watts. To protect the whistle controller, do not blow the whistle when the higher voltages are used or when two trains are running.

Of the many train maneuvers possible on this layout, one of the most interesting, using two distant-control locomotives, is to have one of the locomotives set in its stopped position while the other is moving. Then, by pressing the train-control button (on the whistle controller)



Track layout and wiring. By manipulating switches while trains are in motion, one can be brought in on the main line, the other on the branch

but once, the trains reverse their operations. With a station located at B and power on both lines, stop one train at the station; then, when the other approaches, touch the button. The first train will go, and the second come to a stop at the station.

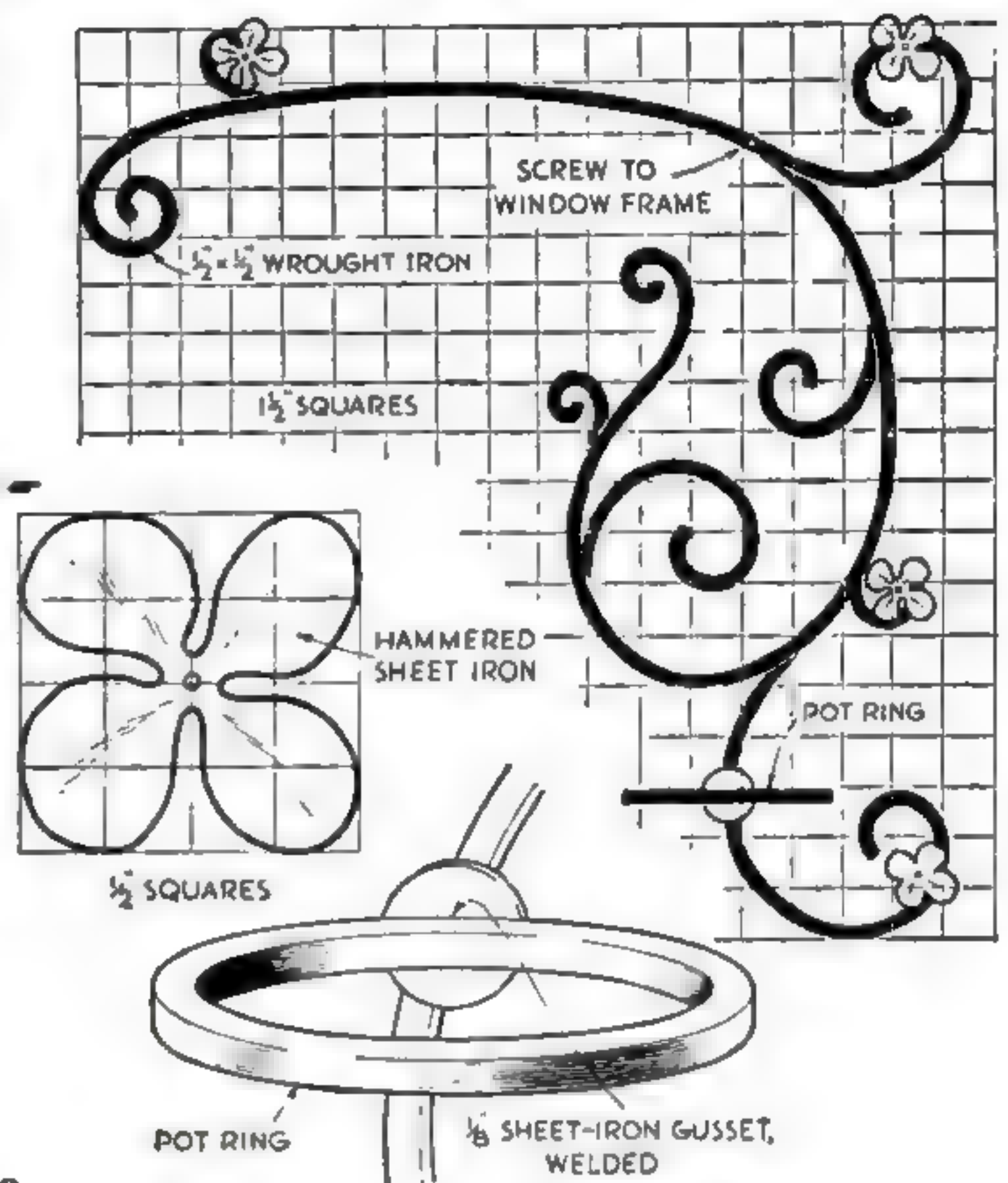


TRACK MATERIAL REQUIRED

- 32 pc. straight track, standard length.
- 4 pc. straight track, cut to length as described.
- 13 pc. curved track, standard length.
- 4 distant-control switches.
- 1 crossover, 45-deg.

If set between the two lines, a station can be used by an express and a local at the same time

Indoor Window Trellis Bent from Square Iron Bars

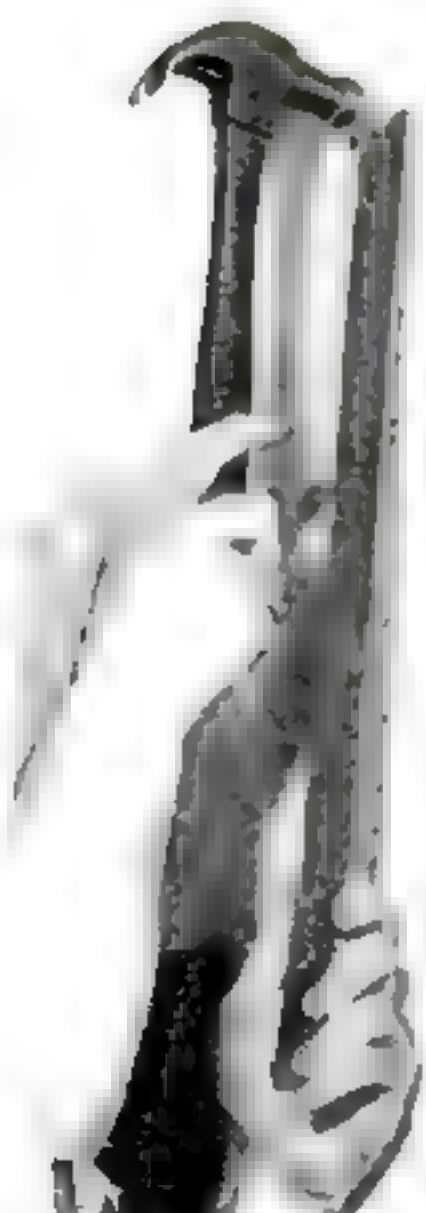


ANY amateur craftsman who has had a little experience in bending wrought-iron will be able to duplicate this attractive indoor trellis. It was designed by Dr. C. H. Lauder, of Arcadia, Calif., and is intended to be fastened over a window in the dining room, kitchen, or breakfast nook.

A full-size pattern should be prepared, preferably on a panel of cheap plywood. The dimensions may be modified as necessary to suit the width of the window. Bar iron $\frac{1}{2}$ " square is used for the scrolls and flowerpot

rings. A gusset of $\frac{1}{8}$ " sheet iron about $1\frac{1}{2}$ " in diameter is placed between each ring and its support, as shown, and the joints are welded. The flower designs are cut from sheet iron, hammered lightly, and either riveted or welded to the frame. Holes are drilled for screwing the trellis to the window trim, and the trellis is enameled white or any color desired. Ivy grown in the pots is trained to climb over the scrollwork.

Holding Nails to be Started In Out-of-the-Way Places



WHEN a nail must be started in an out-of-the-way place such as high up on a wall, it may be held in position by means of a waste strip of pressed composition wood or heavy cardboard, as illustrated at the left. Cut a slit about $\frac{1}{2}$ " long in one end with a pocket-knife and push the nail or tack into the slit. When the nail is well started, the cardboard is removed simply by pulling it away with a jerk. —PHILIP E. WILLMAN.



Lamp Reflectors Kept Waxed for Easy Cleaning

CHROME-PLATED reflectors for photoflash or photoflood lamps are easier to clean if they are coated with ferrotype polish or floor wax. The coating of wax not only enables finger prints and dust to be removed quickly, but also prevents scratching the plated surface. —WALTER GOTTLIEB.



Painted in bright colors, the garage is constructed of $\frac{1}{4}$ " plywood and will house several of a child's toy autos

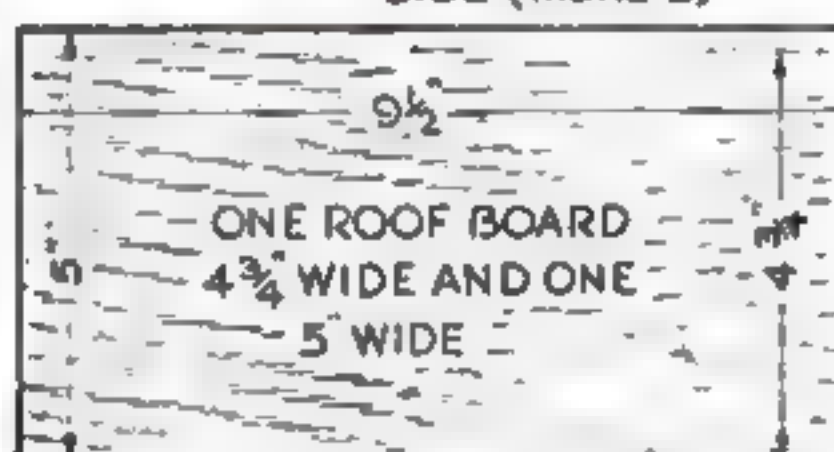


Toy Garage Quickly Made from Plywood Scraps

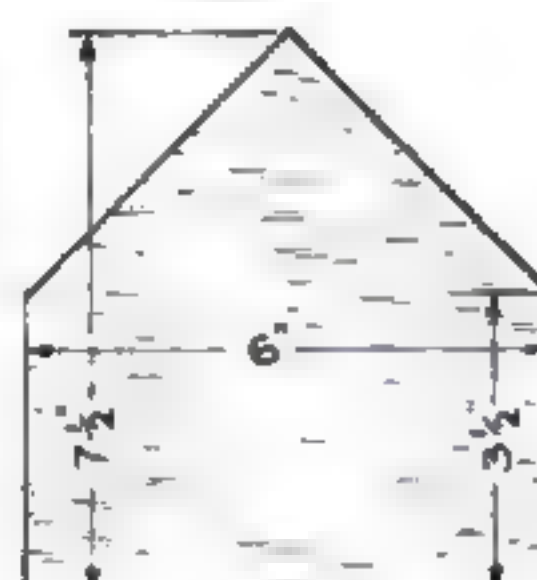
ALMOST every small child acquires a string of toy automobiles, but he is not so likely to have a garage to keep them in. One can be built very quickly, as shown, from $\frac{1}{4}$ " plywood nailed together with $\frac{3}{4}$ " No. 18 wire brads. The narrower of the two roof boards is nailed on, but the wider one is hinged at each end so that it may be raised. The L-shaped hinges are cut from 22-gauge sheet copper or tin. The doors are pivoted on nails, and the lower nail is held by metal hinge pieces. The body of the garage is painted cream color with a red roof and brown doors.—WILLIAM KORTS.



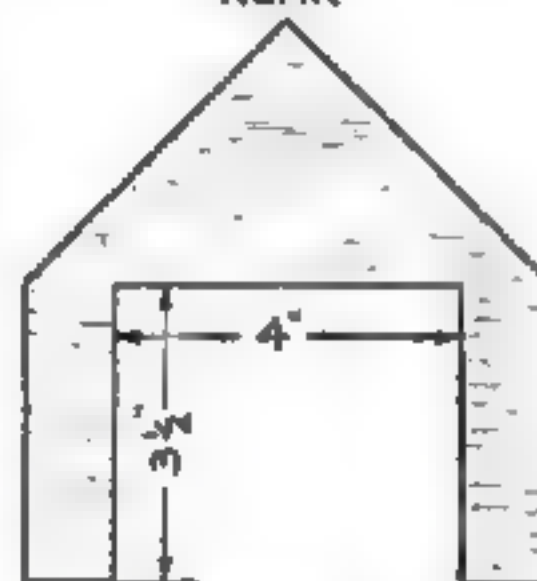
SIDE (Make 2)



ROOF BOARD (Make 2)



REAR



FRONT
ALL MATERIAL
 $\frac{1}{4}$ " PLYWOOD

The wider of the two roof boards is hinged at each end by means of L-shaped pieces of 22-gauge metal held in place with brads

Feet of Portable Typewriter Anchored by Suction Cups

TO OVERCOME the tendency for a light typewriter to slip around on a desk, suction cups may be attached in place of the ordinary rubber feet as at the right. On some makes of typewriters, the bolts that hold the feet are the same size as the bolts vulcanized into ordinary suction cups. Two cups are usually sufficient, but some typists prefer to have a solid grip of this kind on all four feet.—PAUL F. PODUSKA.



Hardware Kept in Tobacco Tins

SCREWS, nuts, brads and small machine parts can be kept in systematic order by using tobacco tins. Mark the tops with white paint or scratch the words in the paint of the tin top. Thirteen standard-size tins will fit into a wooden cheese box. A typewritten list of contents may be pasted on the end of the box.—G. PARKE.

Once She Chased Smugglers



Built to a scale of $\frac{1}{8}$ " equals 1', our "Joe Lane" model is 21" long and 13" high over all. The ship was a topsail schooner

HOW TO BUILD AN ACCURATE *the* PICTURESQUE REVENUE

THE *Joe Lane* was one of the first vessels designed especially for the Revenue Marine, forerunner of the U. S. Coast Guard. She was built in 1848-9 by Graves and Fenbie in Portsmouth, Va., and served many years on the Atlantic Coast running down slavers, smugglers, and pirates. After the Civil War she was sent to the West Coast, where she ended her days in the late sixties.

Our model of this picturesque little revenue cutter is built to a scale of $\frac{1}{8}$ " equals 1' and occupies a space approximately 21" long and 13" high. The materials required are itemized in the list on a following page. Before making any part of the model, study the drawings very carefully. If some of the nautical terms used are unfamiliar to you, consult an unabridged dictionary.

If you intend to build the model from

scratch—that is, without purchasing either the full-size drawings or a complete construction kit with ready-shaped hull block—start by ruling a series of $\frac{1}{2}$ " squares on a large sheet of heavy paper. Reproduce within those squares the outlines of the deck and the sheer plan (side view) of the hull, ignoring the rudder. Transfer the sheer plan to the hull block and saw it out. Next trace the outline of the deck on top of the block and cut it.

Before starting to carve the hull, make a set of cardboard templates of cross sections of the hull at the points shown in the drawing from A to M. Cut a piece of wood about 1" in diameter and screw it to the deck so you can hold the hull in your vise and rotate the block when shaping. In carving the hull, start amidships and work from there toward the stern and then to the bow.



SCALE MODEL OF CUTTER "JOE LANG"

By EMANUELE STIERI

Bring the shape down evenly; do not attempt to finish any one section by itself. Follow the grain of the wood and keep fitting the templates at their correct sections. A simple method is to rub a soft lead pencil along the edge of the template; a slight movement will then transfer the lead to the high spots at that section. Work these down until one continuous black line from keel to deck assures that the exact shape has been attained at that point. Carving a hull is not a job that can be done in a short time, so proceed slowly and carefully. Carve almost up to a marked line then finish off to the line with sandpaper.

After the carving has been completed, sand the entire hull and proceed with routing out the block to a depth of $\frac{5}{16}$ " for the main deck and $\frac{1}{8}$ " for the raised decks.



SAWED



CARVED



ROUTED



RUDDER AND MOLDING ADDED

Four steps in shaping and completing the hull. At left, Mr. Stieri puts several final touches on the model

COLORING THE MODEL

Copper. Underbody and rudder up to scored water line.

Black. Outside of hull from water line to cap rail. Bowsprit and jib boom to cap. Mast doublings from futtock band to cap. Crosstrees and spreaders. Poles of fore and main. Jib-boom tip. Whisker booms and dolphin striker. All "ironwork." House tops and wheel-box top. Galley stack. Standing rigging and pendants of running rigging.

Gray. Knightheads. Inboard end of catheads and bowsprit. Masts from deck to fife rails. Hatch coamings. Sides of houses and wheel box. Bulkheads of cabin trunk and forecabin head. Inboard side of bulwarks. Waterways and timberheads.

White. Trysail and main gaffs. Main boom.

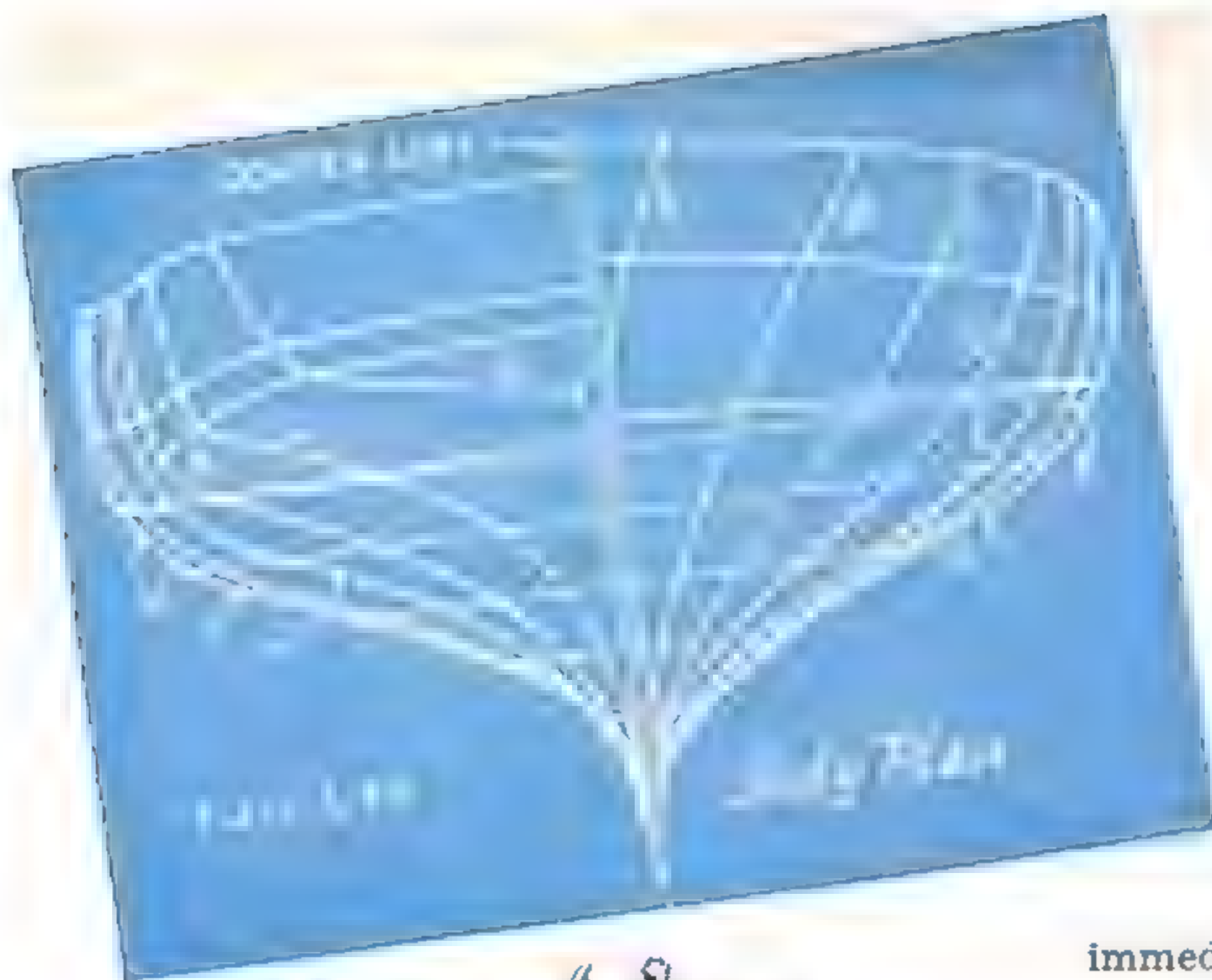
Mahogany (stain). Cabin skylights and hatches, cap rail, steering wheel, fife rails.

Bright (unpainted except for clear varnish for protection). Decks and all spars not listed above. All blocks.

Gilt. Scrollwork and figurehead.

Yellow. Sheer molding.

Revenue Marine Ensign. Thirteen red and white vertical stripes; a white eagle and ribbon on a blue field.



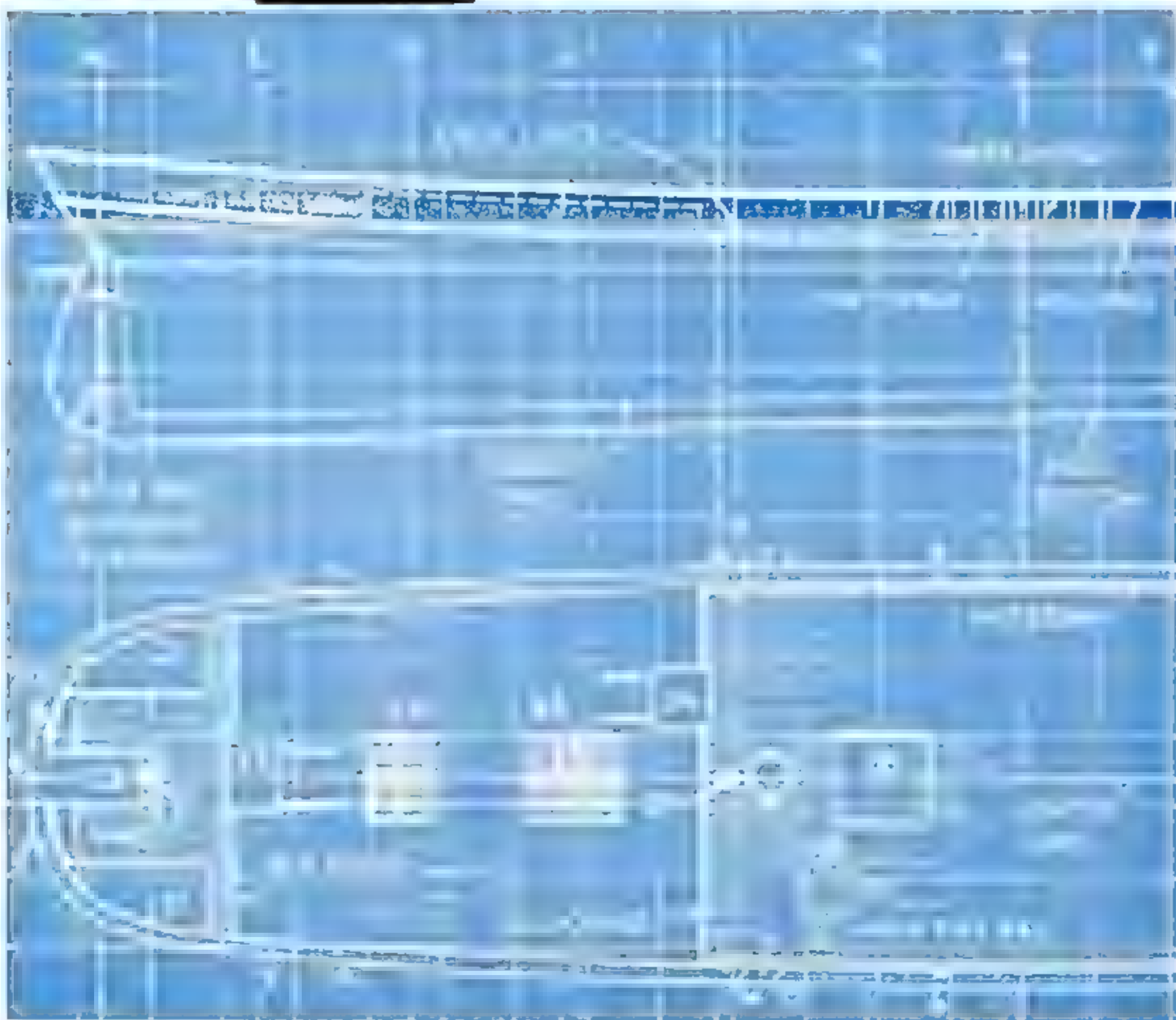
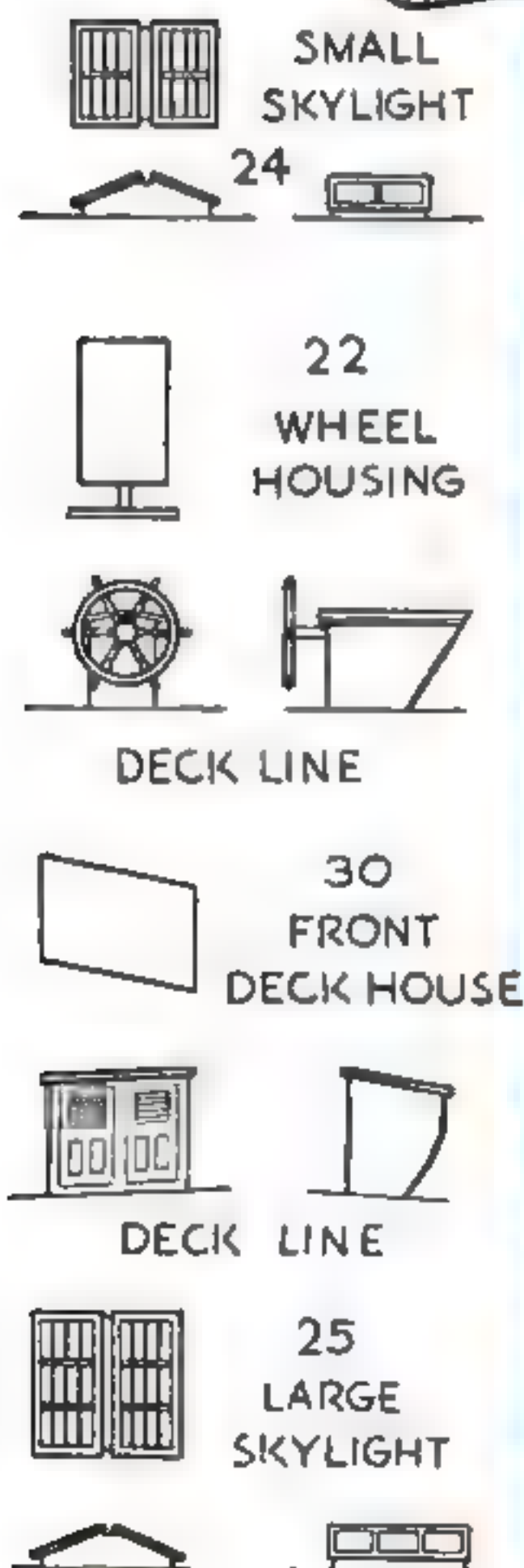
Leave a bulwark standing all around the hull. If you have a router, it is a simple procedure; if not, you will have to use chisel and gouge. Proceed slowly and continually check the work for accuracy. Even up the entire deck space carefully with sandpaper.

For the deck planking, use a sheet of single-ply veneer. Sand the face side with No. 000 sandpaper and apply several coats of clear white shellac. When the shellac has dried, score the deck lines with a sharp-pointed nail or a drawing pen; then rub black ink or thin black paint over the entire surface, and rub it off immediately. It will penetrate the scored lines and give the effect of a planked deck. Cut this sheet to the required shapes and sizes and glue to the deck.

Notch the bow, shape the bowsprit and fit it in place. Cut the cap rail to the contour of the ship and fasten it around the top of the bulwarks. Add the buffalo, waterways, and timberheads; and on the outside, the rudder and molding.



Left, using a pencil marker to inscribe the water line on the hull of the model



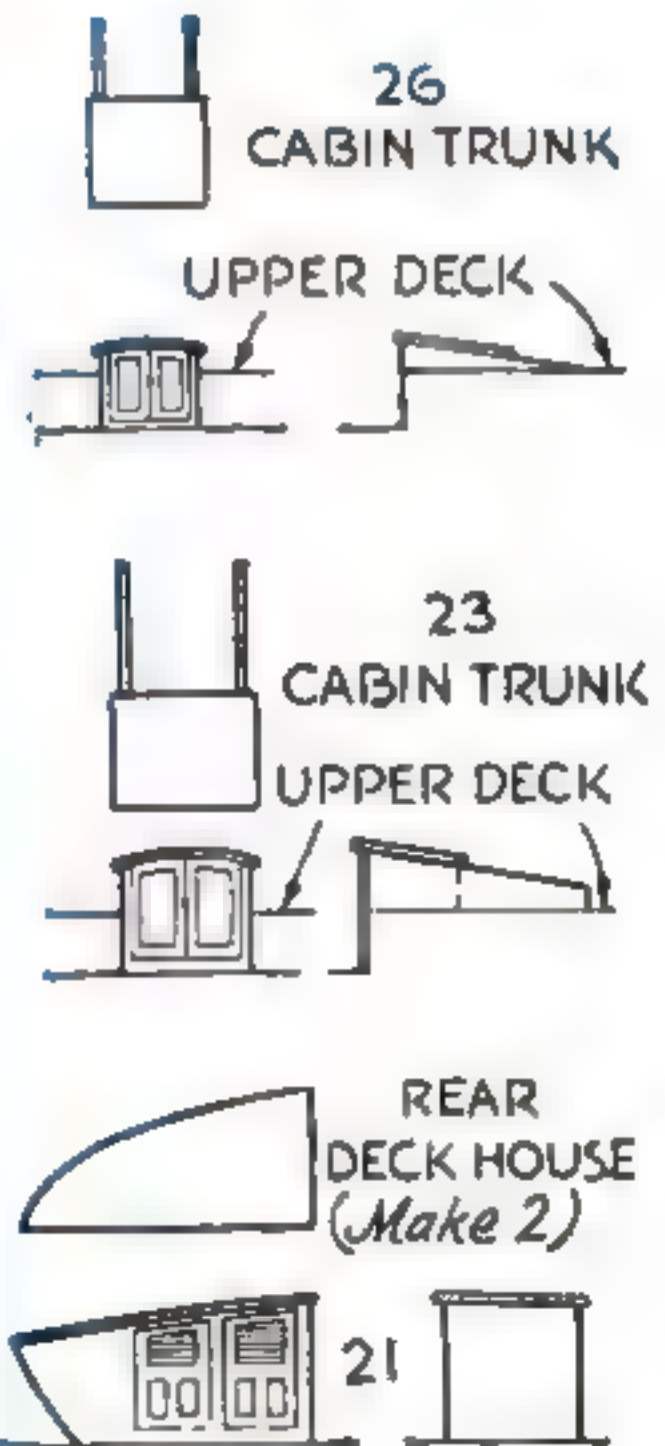
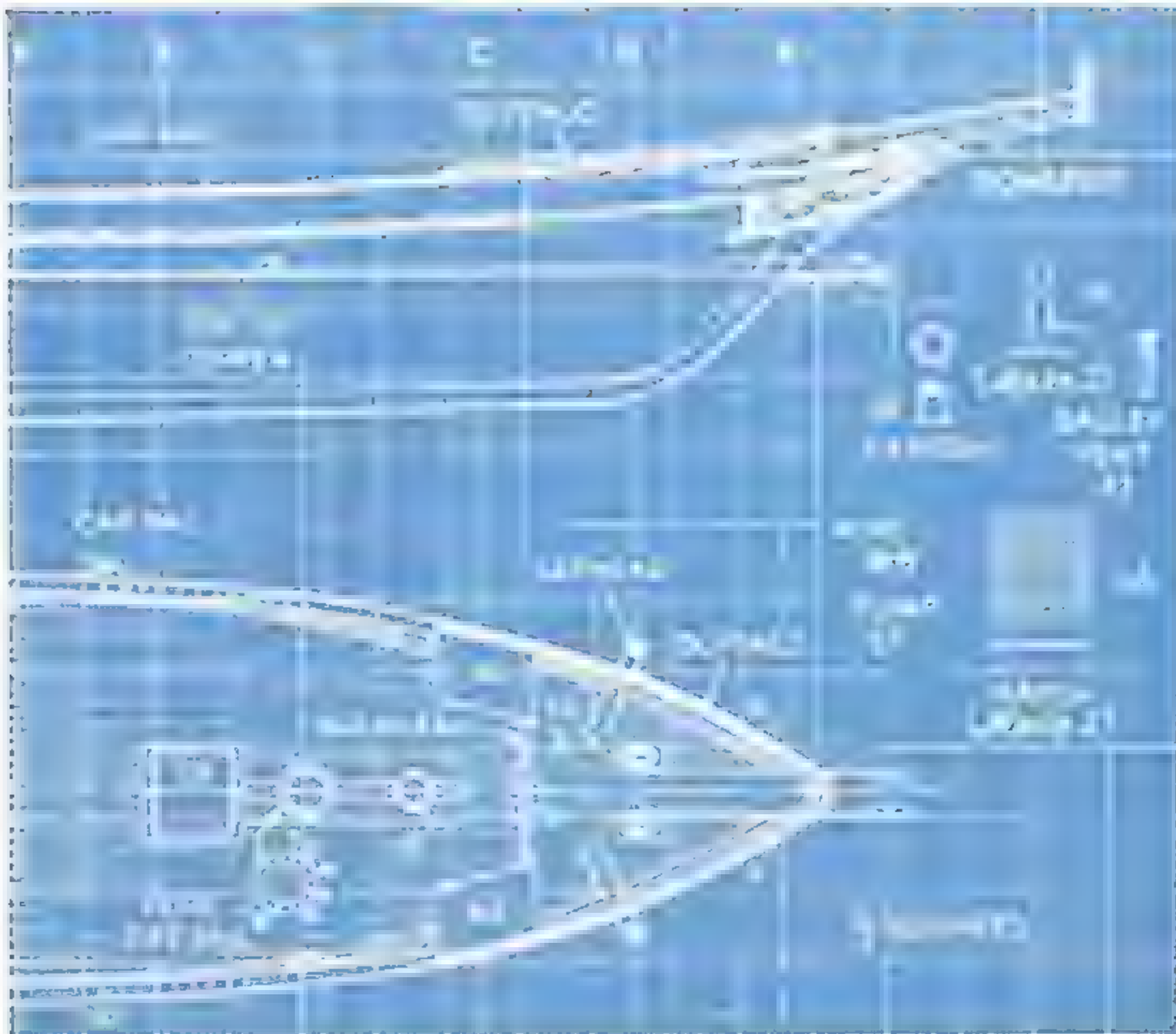
Sand the hull again with No. 000 sandpaper and apply several coats of orange shellac, thinned liberally with alcohol. Rub with No. 000 sandpaper between coats. When dry, turn the hull upside down and brush three coats of a good black paint over the entire outside surface, except the cap rail. After the last coat is dry, the water line should be scribed with a hard pencil as shown. Finally, apply two coats of copper bronze powder mixed with bronzing liquid or "banana oil" on the underbody. When dry, rub all down with rottenstone and water.

While waiting between coats of paint, you can make the various deck houses and fittings. The drawings are numbered to agree with the deck plan. These parts can be shaped from solid wood or built up from thin veneer or plywood. They should be sanded and painted before being set in place. Be sure to use flat, not glossy, paint. Complete paint specifications for the model are given on an accompanying chart. A good finish for masts, spars, and other parts, unless otherwise noted in the painting specifications, is a little burnt umber (in powder form) mixed with some clear varnish. This gives a weathered effect. Cut the figurehead and trail boards from two pieces of shim brass or fashion them from plastic composition wood, then fasten in place as shown.

(TO BE CONTINUED)

LIST OF MATERIALS

- 1 pc. white pine 2½" by 3½" by 13½" for hull.
 - 3 pc. white pine 3/32" by 3/32" by 14" for catheads, wales, crossrees, spreaders, timberheads.
 - 2 pc. white pine 3/32" by 1½" by 14" for cap rails, rudder, caps, cheeks, saddles, waterways, gaff and boom jaws, etc.
 - 1 pc. white pine ¼" by 1" by 6" for wheel house, hatches, companionway.
 - 1 pc. veneer—single ply 3½" by 14" for deck, houses, house trim, bulkheads, etc.
 - 2—¼" dowels each 12" for lower masts, bowsprit.
 - 3—3/16" dowels each 12" for top masts, spars, gaffs, boom.
 - 1—3/32" dowel for dolphin striker, whisker booms, etc.
 - Blocks—3/32" single, 30; ½" single, 3; 3/32" double, 6; ½" double, 1.
 - Deadeyes—3/32", 32; ½", 32.
 - Bullseyes—3/32", 10.
 - Belaying pins—3/16", 24.
 - ⅜" steering wheel, 48 pad eyes 3/16" long, 2 small anchors, spool fine ecru thread, spool fine black thread, spool medium black thread, spool 32-gauge steel wire, package small model pins; sandpaper No. 0, No. 00, No. 000; shellac and paint.
- Note: A jeweler's fret saw and small hand drill are desirable in addition to ordinary woodworking tools. Use No. 80 drill for jack-stay eyebolts, No. 75 for model pins, No. 65 for belaying pins.



Left, half-size drawings of the deck and profile. Deck fittings, also half size, are shown above and on opposite page



Miniature Steering Wheel Keeps Baby Amused

THE addition of a miniature steering wheel to a baby's auto seat of the type illustrated above will keep a small child content during a long ride and prevent him from reaching for other objects or possibly falling in an effort to grasp the real steering wheel of the car. The shaft is a piece of old broom handle about 14" long on one end of which is nailed a toy wheel or disk of wood so that it can be turned easily. The other end of the broomstick is fitted into a pipe flange, which is then screwed securely in place on the foot rest of the baby's auto seat.—JOSEPH LAVENDER.

Crosscutting Wide Boards on a Small Bench Saw

WIDE boards can be squared on a small circular saw by reversing the normal position of the miter gauge so that the farther edge instead of the nearer edge of the board is pressed against it. A saw table of the size illustrated below will allow a board 7" wide to be squared off in the usual way, but when the gauge is reversed and placed at the rear as shown, a board fully 14" wide may be squared with ease.—C. A. KING.



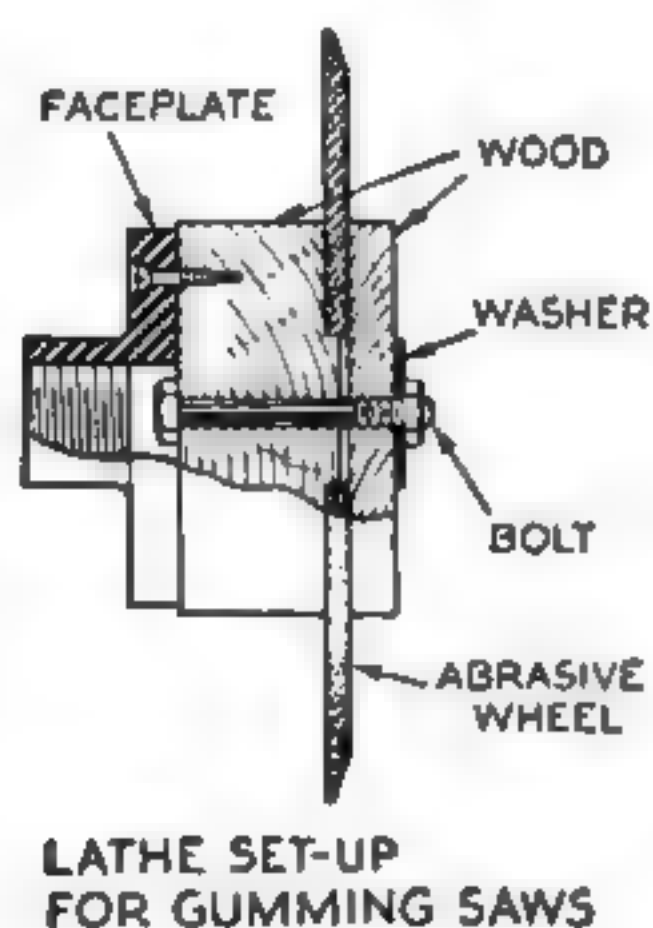
JOINTING AND GUMMING SAWS

[WOODWORKING]

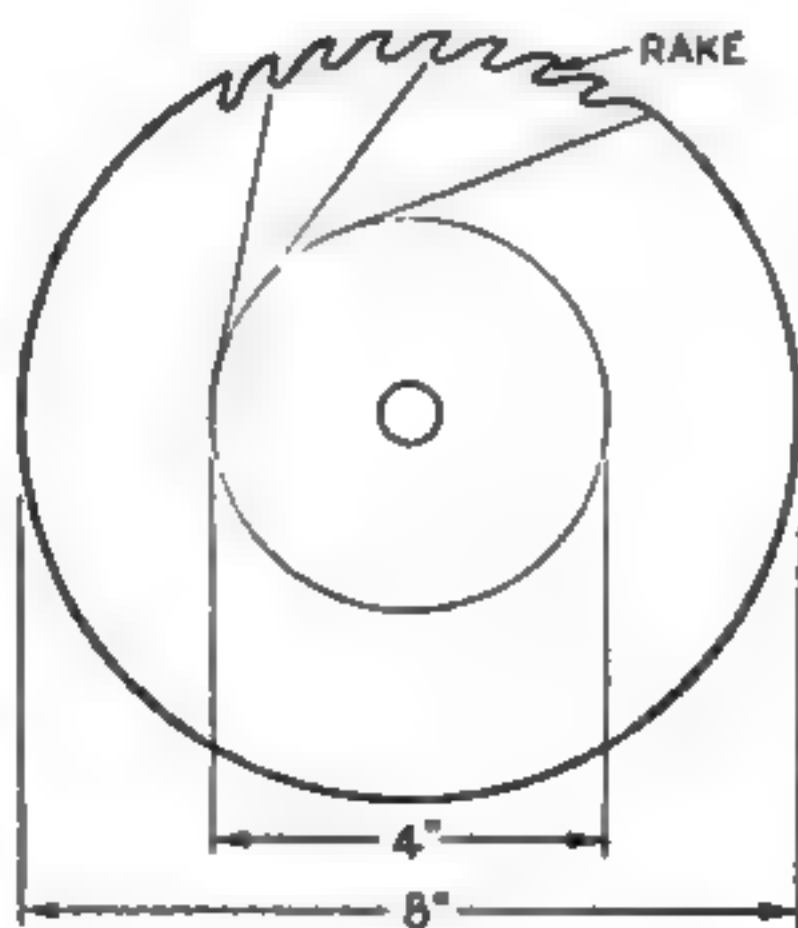
To joint a circular saw, bring the top of the teeth just below the saw table. Start the machine and pass an

oilstone back and forth across the revolving saw. Raise the saw a trifle and continue until all the teeth have been touched by the stone.

"Gumming" means to shape the front of the teeth (the "rake") and make the gullets deeper. This may be done with a mill file with rounded edges or with a properly shaped abrasive wheel mounted in a lathe, the saw being supported on the tool rest. Find the rake of a circular rip saw by drawing tangents from the teeth to a circle of one third to one half the diameter of the saw, as shown. Crosscut and miter saws are gummed similarly, but the angle of the rake differs.



LATHE SET-UP FOR GUMMING SAWS



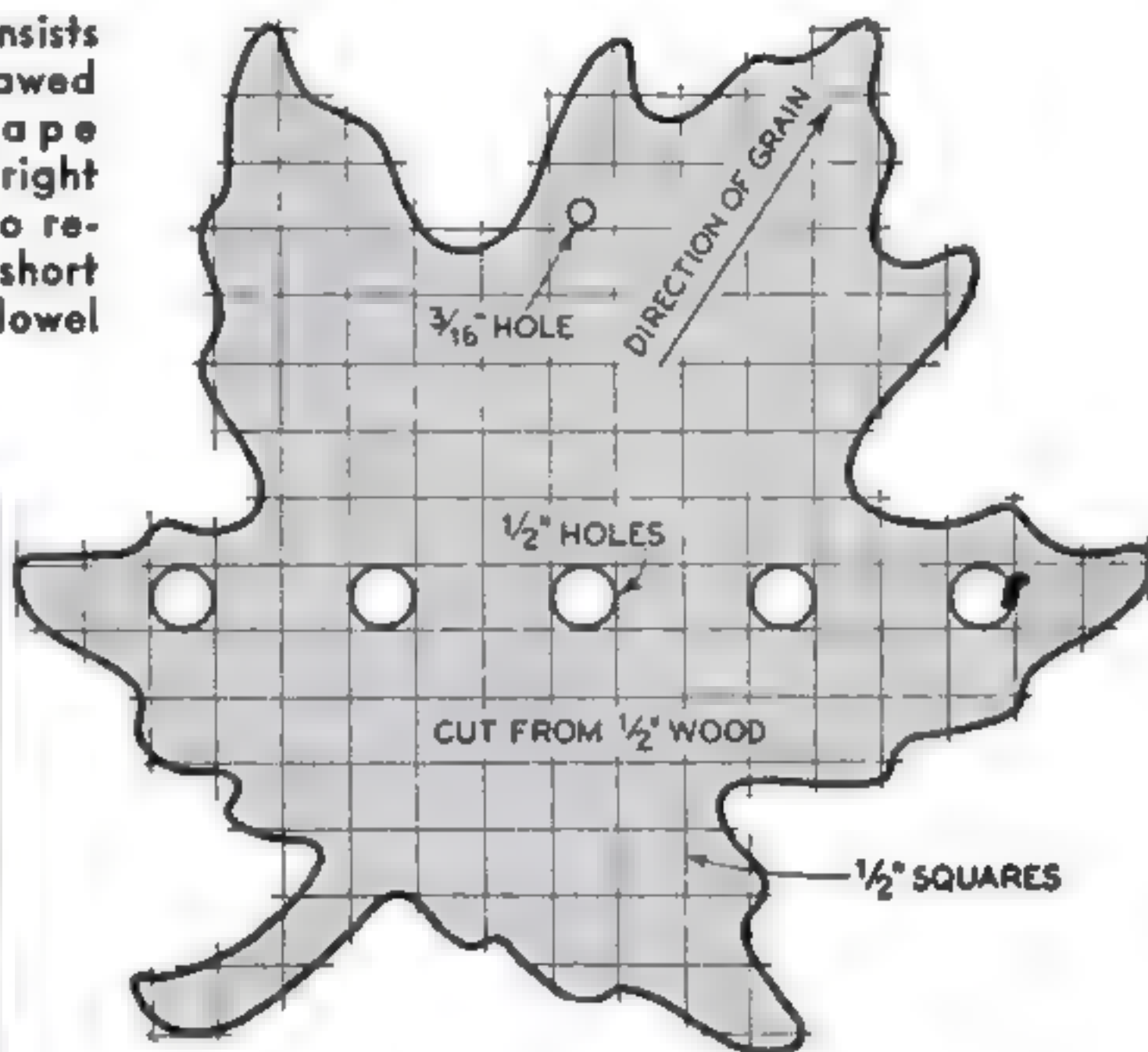
POPULAR SCIENCE MONTHLY SHOP DATA FILE

A Scroll-Sawed Tie Rack of Maple-Leaf Design



DESIGNED especially for Boy Scouts, this necktie rack is shaped like a maple leaf and painted green. The leaf may be cut by hand from $\frac{1}{2}$ " thick wood with a coping saw or on a power scroll saw, if available. Five holes are bored to receive wooden dowels, $\frac{1}{2}$ " in diameter by 2" long. The rack is fastened to the wall with a single screw.—G. A. SMITH.

The rack consists of a board sawed to the shape shown at the right and bored to receive five short pieces of dowel



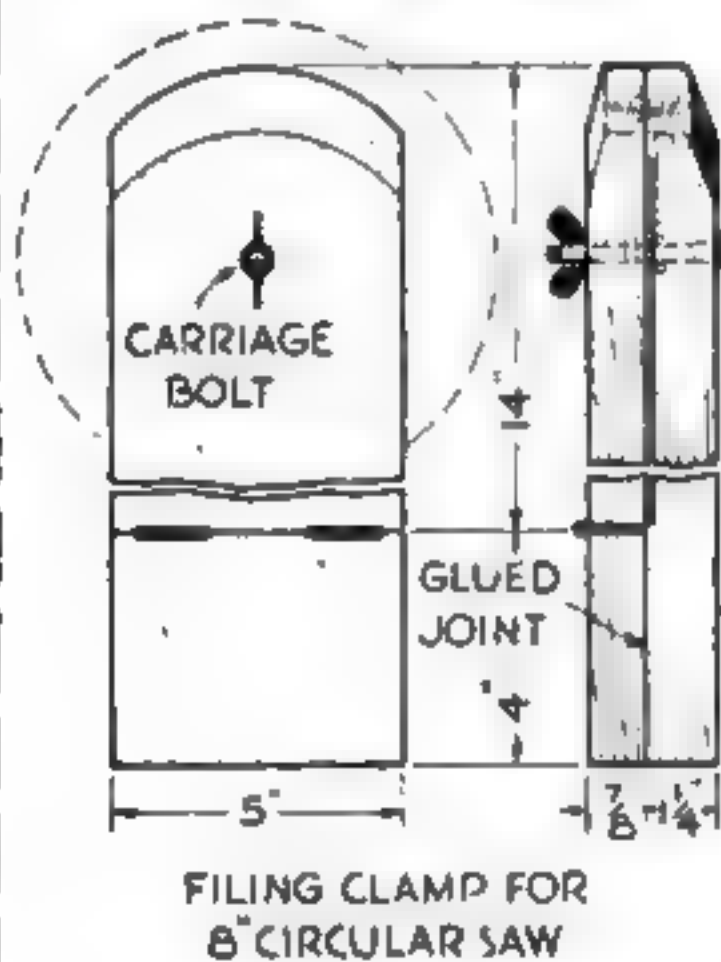
After the backboard and the pegs have been well sanded, the rack is painted a leaf-green color

Improving an Electric Shaver

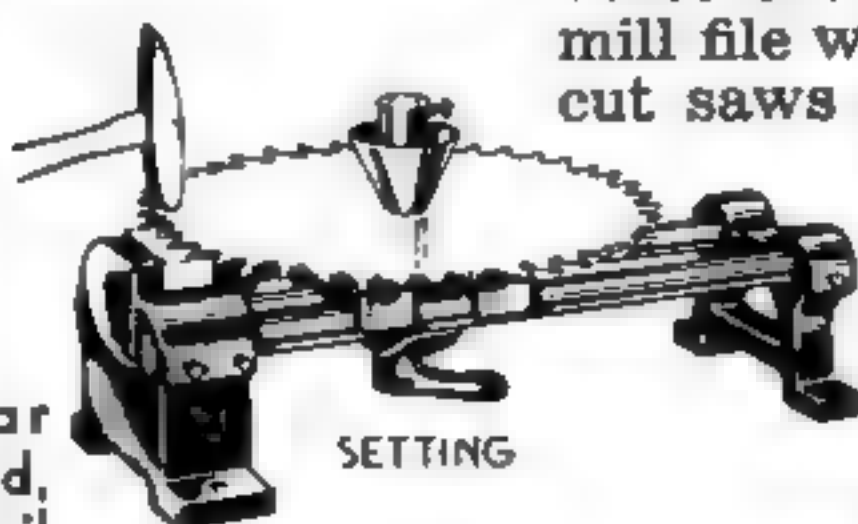
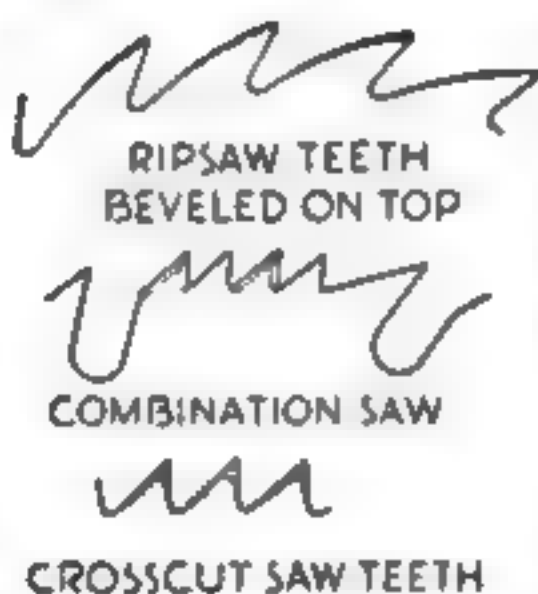
ELECTRIC shavers that operate erratically can often be improved by opening the housing and very lightly sandpapering the contact points. A good tool for this is a so-called "emery board" sold for manicure use.

SETTING AND FILING CIRCULAR SAWS

[WOODWORKING]



Vise for filing circular saws; shapes of teeth; and, right, a saw-setting anvil



Small circular saws are usually set with an ordinary saw set or with a hammer-and-anvil set. Bend only the upper third of each tooth. Combination saws are, as a rule, hollow ground and therefore require no set. Clamp the saw in the filing vise and file rip-saws with a slight bevel on top. File the teeth set away from you first; then reverse the saw and file the rest. Use a mill file with rounded edges. File crosscut saws like handsaws, using a blunt band-saw file. Work the file well into the gullets to deepen them. File raker teeth on combination saws straight across and $\frac{1}{32}$ " below the crosscut teeth to prevent tearing the wood.

POPULAR SCIENCE MONTHLY SHOP DATA FILE

Step-Saving Kitchen Worktable

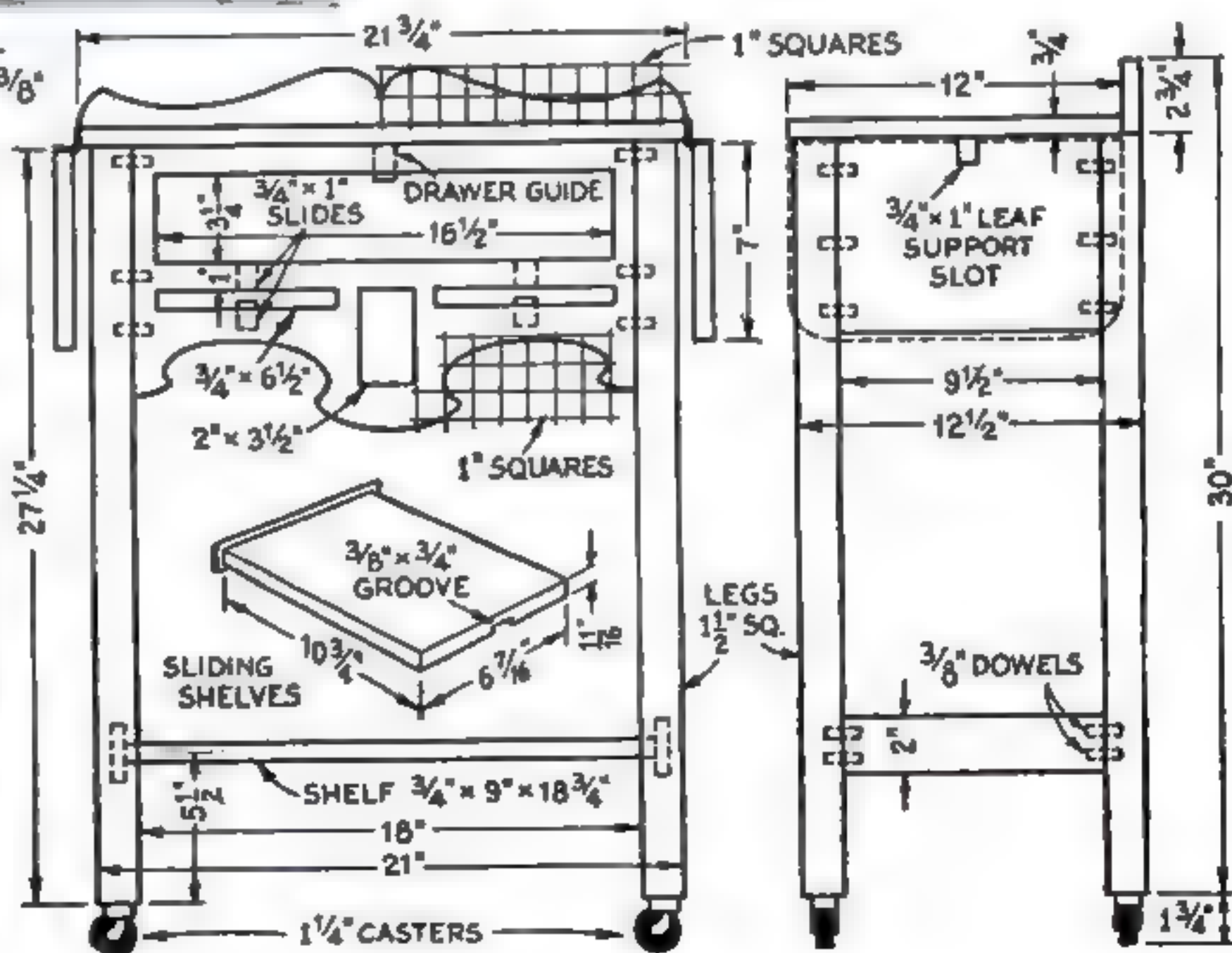
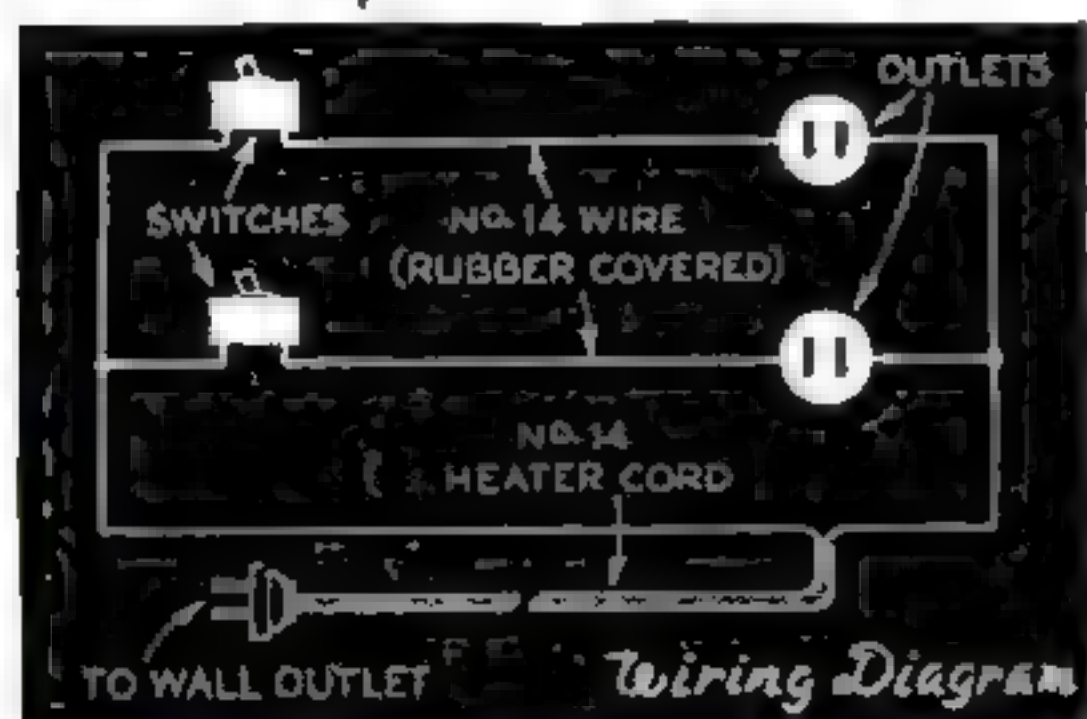
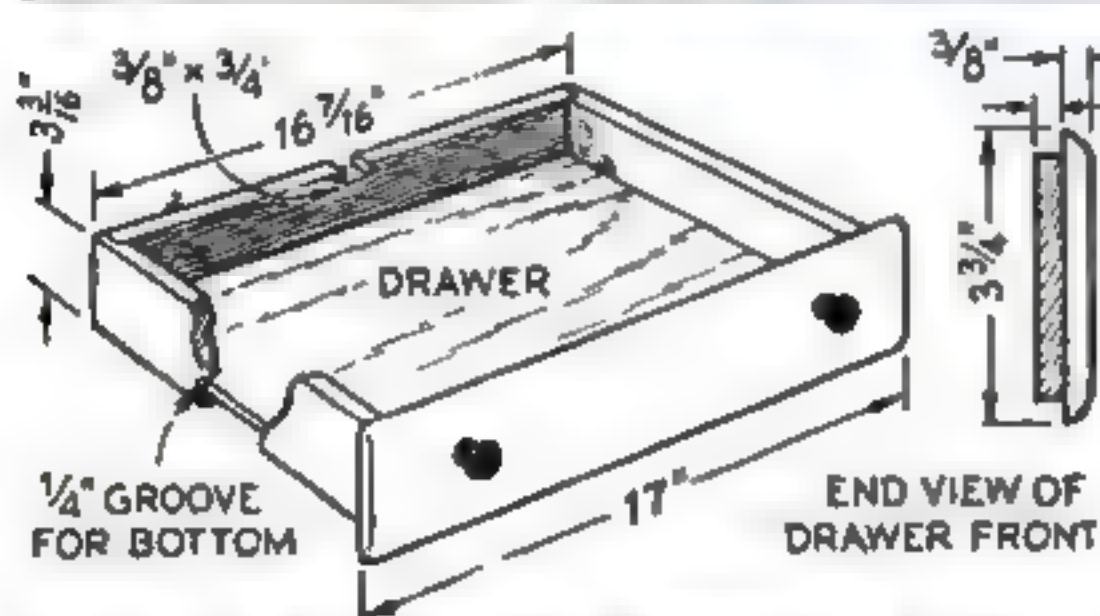
HAS BUILT-IN OUTLETS AND SWITCHES

ANY busy housewife will appreciate the step-saving efficiency of this movable kitchen table. It has a built-in electrical unit that permits any two kitchen appliances, such as a waffle iron and a percolator or a toaster and a mixer, to be used simultaneously or separately, as desired. The appliances are controlled by switches in front. The table also has two sliding shelves for holding plates or cups while serving.

The materials and electrical fittings for the original table cost about five dollars. Well-seasoned $\frac{3}{4}$ " pine is satisfactory and will make a sturdy table. Cut the openings in the front, which is a $\frac{3}{4}$ " by 12" by 18" board, and assemble the front, sides, back, and lower shelf rails, using $\frac{3}{8}$ " by $1\frac{1}{2}$ " dowels. Care should be taken when drilling the dowel holes so that they don't come together in the legs.

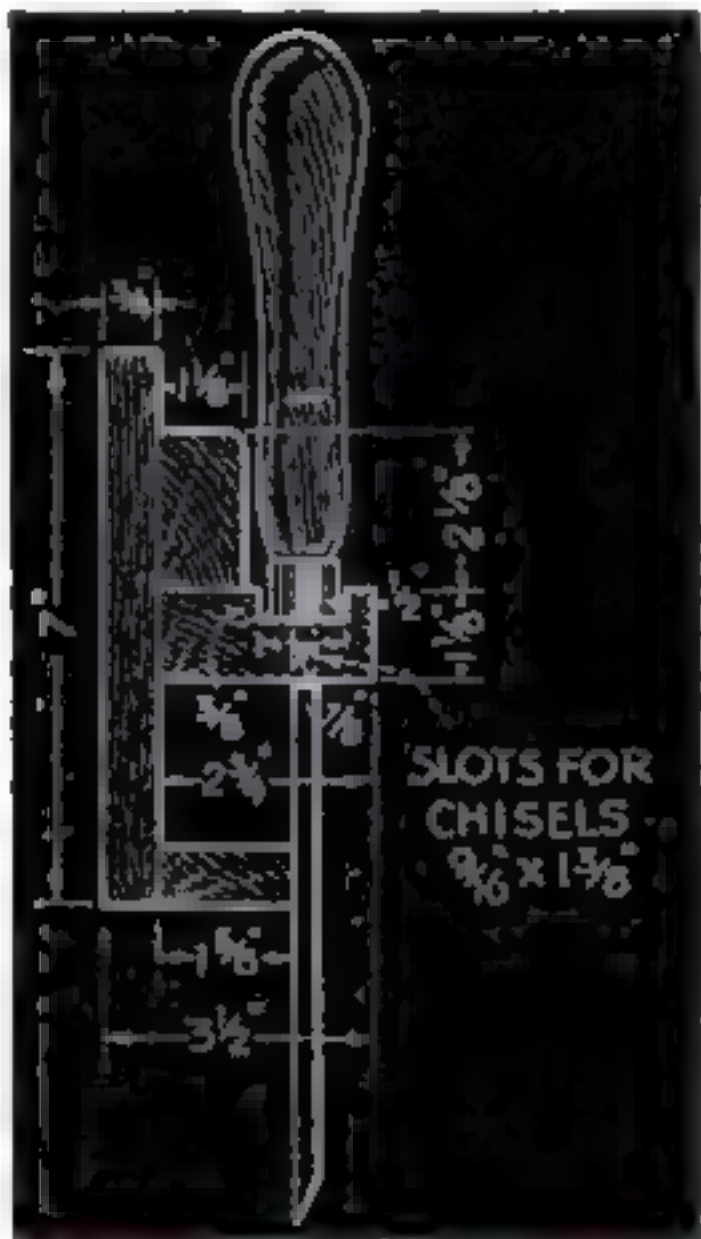
Cut two pieces $\frac{3}{4}$ " by 1" by $20\frac{1}{2}$ " for the leaf supports. These are placed lengthwise on top in the center, and slots are cut in the top of the sides and the drawer guide. Fasten the scrolled back to the top, and the top to the frame, with four 1" corner irons. Two pair of hinges are required for the leaves. The lower shelf can be fastened through the side rails with screws.

The following electrical equipment is required: Two 2" by $3\frac{1}{2}$ " loom switch boxes; two interchangeable outlets with one two-gang plate; two 10-ampere, 125-volt single pole toggle switch with one two-gang plate; 3' loom; 5' No. 14 rubber-covered wire; 6' No. 14 heater cord with a plug connected to one end. The outlets are for appliance use, and the heater cord is used for connecting the table to a wall outlet. The wiring will handle up to 1,500 watts safely.—FRANK HEGEMEYER.



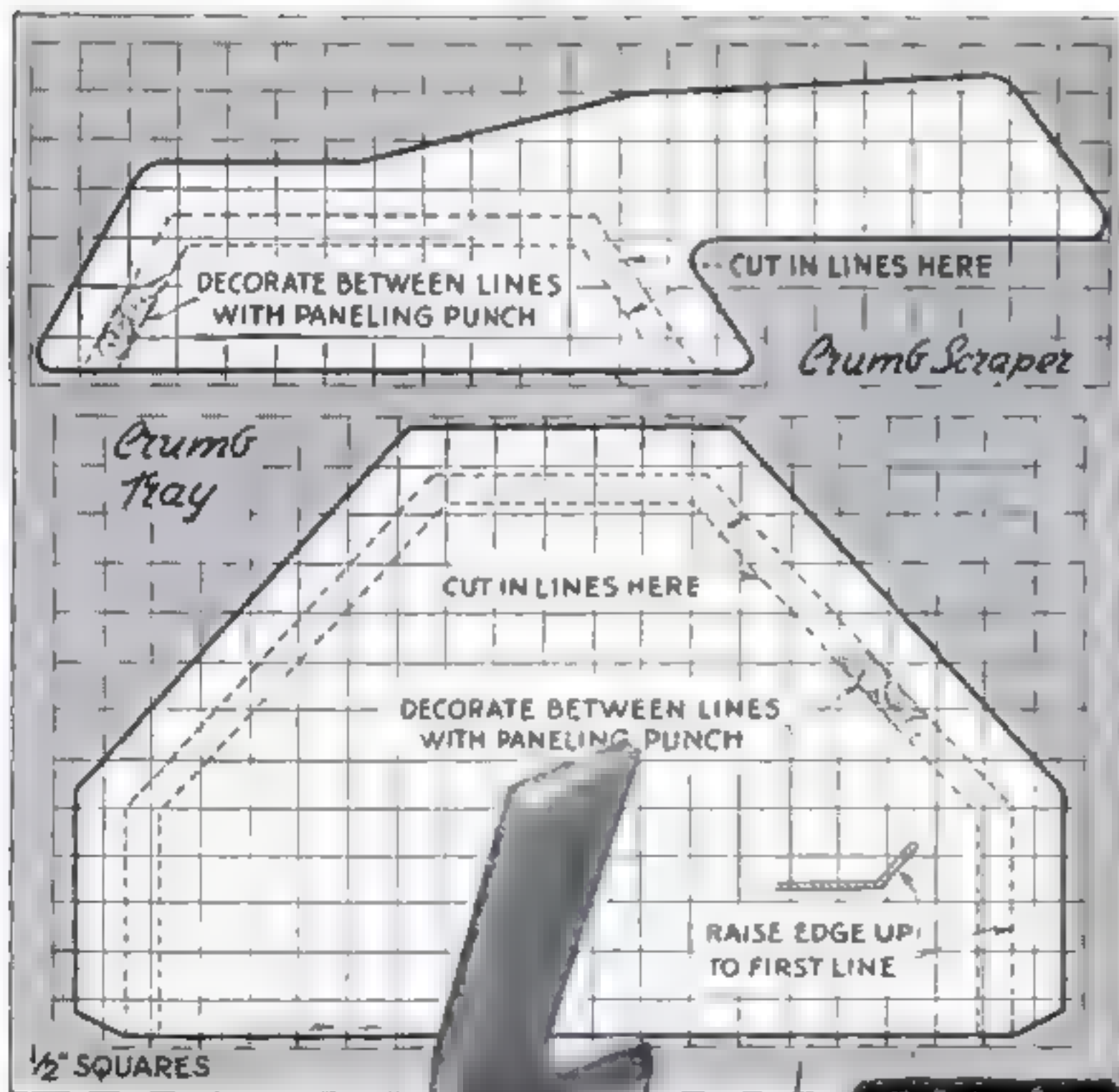
Rack Keeps Chisels Ready for Wood Turner's Use

BESIDES being neat and workmanlike, this rack for wood-turning chisels is convenient to use because the chisels may be removed and replaced so easily. Pine will serve for all parts with the exception of the slotted piece that supports the chisels, which preferably should be of maple, oak, or other hardwood. The dimensions suggested in the drawing are for chisels with $1\frac{1}{4}$ " diameter handles, but they may be changed as required. A handy location for this type of chisel holder is on the wall back of the lathe and about a foot to the right as shown in the photograph.

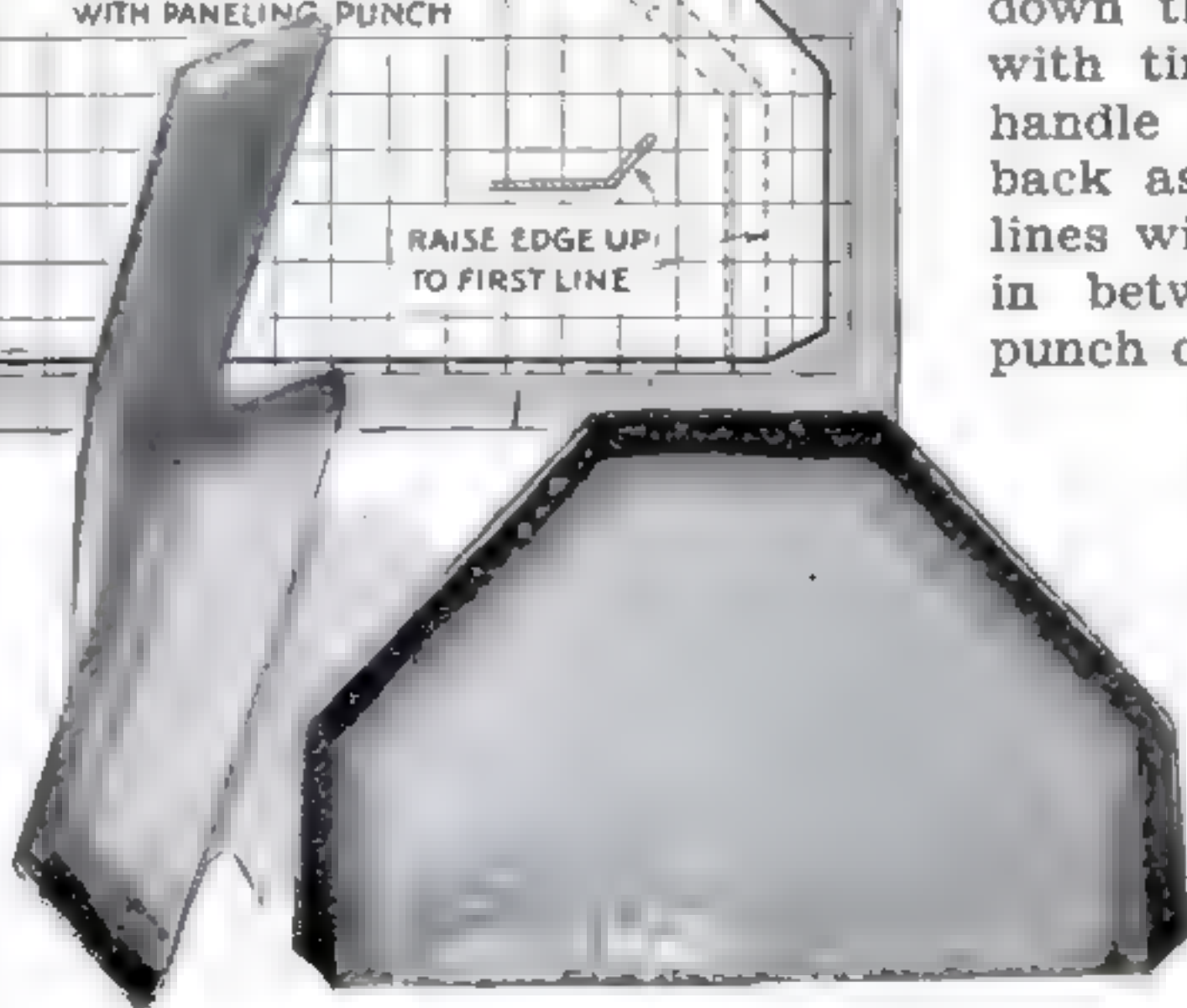


The chisels are handy to grasp. Dimensions at left may be altered to suit size of chisels

Hammered Aluminum Crumb Tray and Scraper



The blanks are cut out of aluminum as shown in the drawings, then hammered, bent, and tooled to give finished pieces like the ones at the right



NOW that hammered aluminum has become so popular, amateur craftsmen who are interested in decorative metal work will enjoy making pieces of this type. Two simple pieces to start with are the crumb tray and scraper illustrated, which require only about a square foot of 18-gauge sheet aluminum.

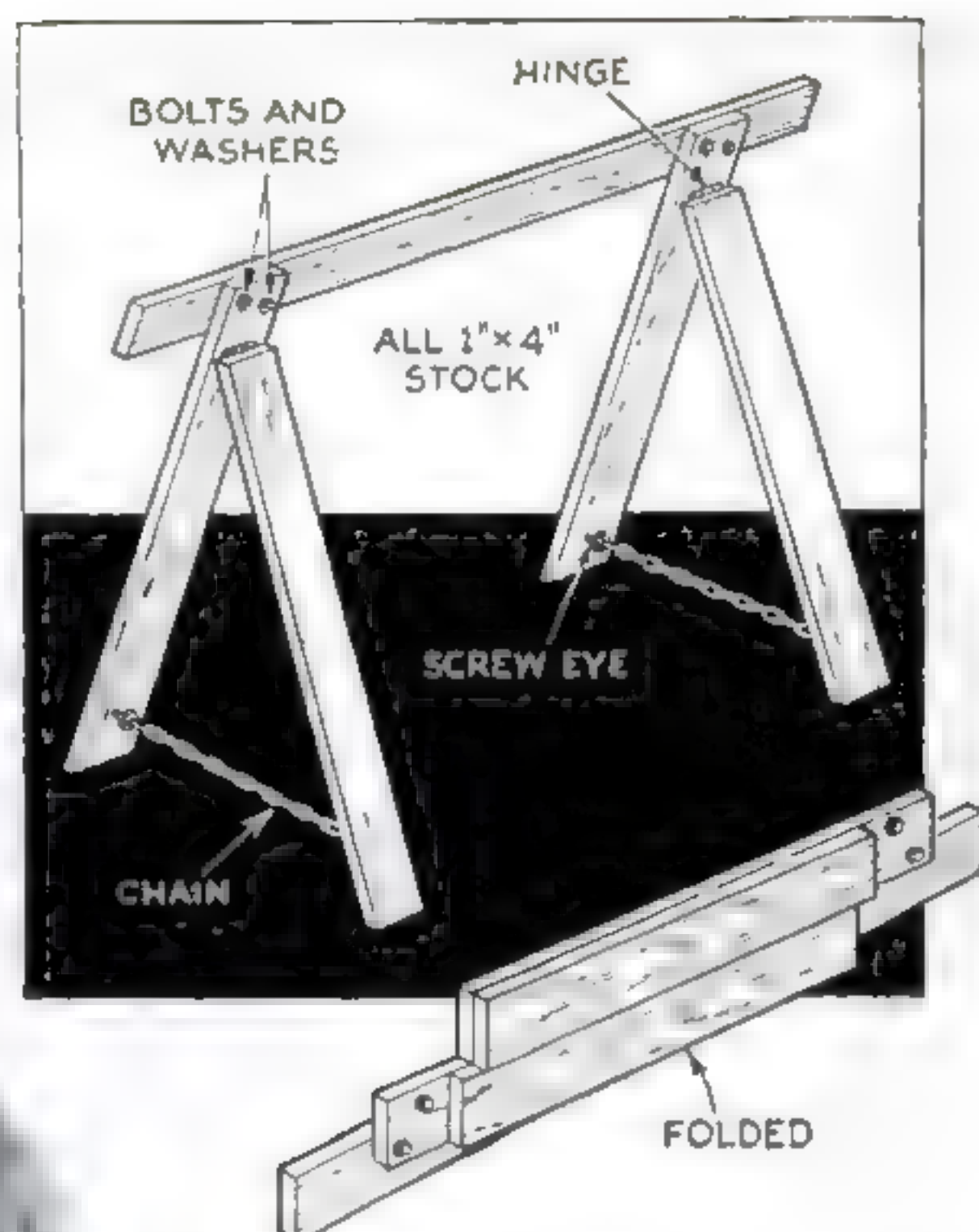
Cut out the shapes with tin shears and raise $\frac{1}{2}$ " of the edge of both pieces where indicated. Hammer them all over with a planishing hammer and bring the front of each piece down thin; then clean up the edges with tin shears and file. Shape the handle of the scraper and round the back as shown. Cut in each pair of lines with a blunt cold chisel and fill in between them with a paneling punch or an ordinary nail set. Finally, buff or polish the tray and scraper. No lacquer needs be applied to pieces of this type.—DICK HUTCHINSON.

ly, buff or polish the tray and scraper. No lacquer needs be applied to pieces of this type.—DICK HUTCHINSON.

Subscribers are requested to notify us of change of address four weeks in advance of the next publication date. Give old and new address.



Light Wooden Horses Fold Up Compactly for Carrying



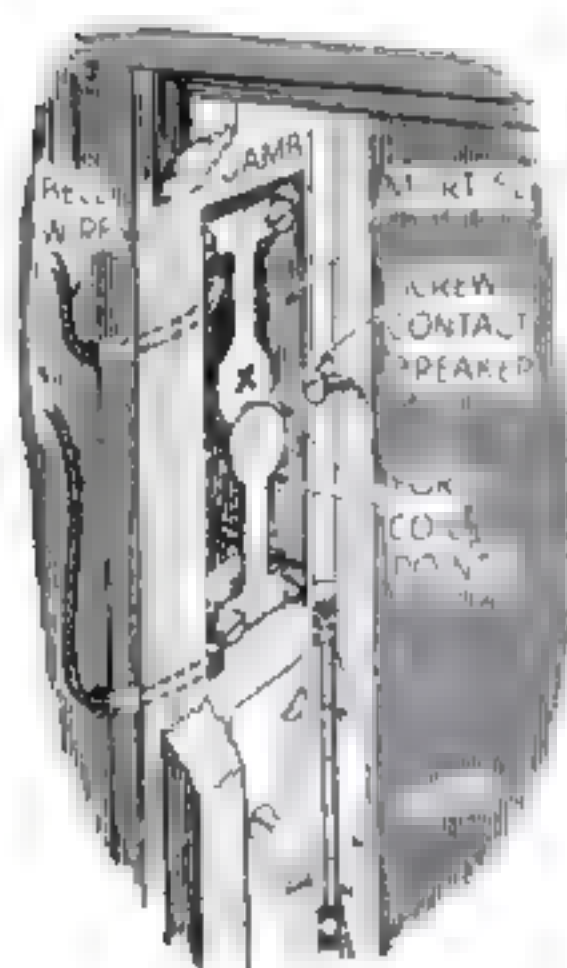
How the portable sawhorses are made. To fold them it is necessary merely to remove one of the bolts from each leg

ORDINARY sawhorses take up considerable space when not in use and are awkward to carry from one job to another, but this difficulty may be overcome by making them so that they will fold up.

Any sound 1" by 4" boards can be used, even pieces taken from packing cases, unless the sawhorses are required for heavy

duty, in which case dressed hardwood is better. The two shorter legs are hinged to the long legs with heavy hinges at least 2½" long, and chains are added to prevent the legs from spreading. To fold up one of these sawhorses, a bolt is removed from each leg. It is then replaced in the free hole to prevent loss.—F. A. BLUHM.

Electric Burglar Alarm for a Poultry House



AN ALARM for a poultry house door can be made by cutting a mortise high up in the door jam and installing a set of old Ford coil points or similar contacts, as shown. A roundheaded screw is then screwed into the edge of the door in such a position that it will press against the inner contact when the door is closed, thus

forcing the points apart. Bell wires are carried from the contact through old water pipe or secondhand conduit buried about 6" below the surface of the ground. The wires are connected to an electric door bell and a transformer in the usual way. A good place for the location of the bell is in the owner's bedroom.—FRED H. SCHULTZ.



Improvised Pipe Wrench

A PAIR of gas pliers and a C-clamp will serve in an emergency as a substitute for a small pipe wrench. This combination is especially useful when it is necessary to get into places too narrow for a 10" or 14" pipe wrench, as, for example, between a union nut and a fitting coupled together with a close nipple. Stubborn stud bolts can often be started in this manner.—A. S. J.



Members of the Niles (Calif.) Homeworkshop Guild making signs in the shop of William Marshall

Home Workshop Club Constructs Street Signs for Home Town

VISITORS to *Niles, Calif.*, will have no difficulty in finding their way around, because seventy-five street signs have just been completed by the Niles Homeworkshop Guild and are being erected with the help of the Junior Chamber of Commerce.

Credit for the idea of making the signs goes to Dr. T. C. Wilson, who also obtained the assistance of the town's business men and arranged financial aid for the project. Assisting him in the work are five other members: C. B. Crane, E. F. Glassbrook, Louis Mayer, L. M. Avilla, and William Marshall. The signs were made in the workshops of Mr. Glassbrook and Mr. Marshall.

Many other home workshop clubs affiliated with the National Homeworkshop Guild are helping to improve their towns and cities. The *Saginaw (Mich.)* Homecraft Club is making bird houses for the city park. A community playground with swings, see-saws, sand boxes, and slides has been constructed by the *Midland (Pa.)* Homeworkshop Club. Hundreds of clubs are making toys and repairing old ones to give to poor children at

Christmas (see P.S.M., Oct. '39, p. 245).

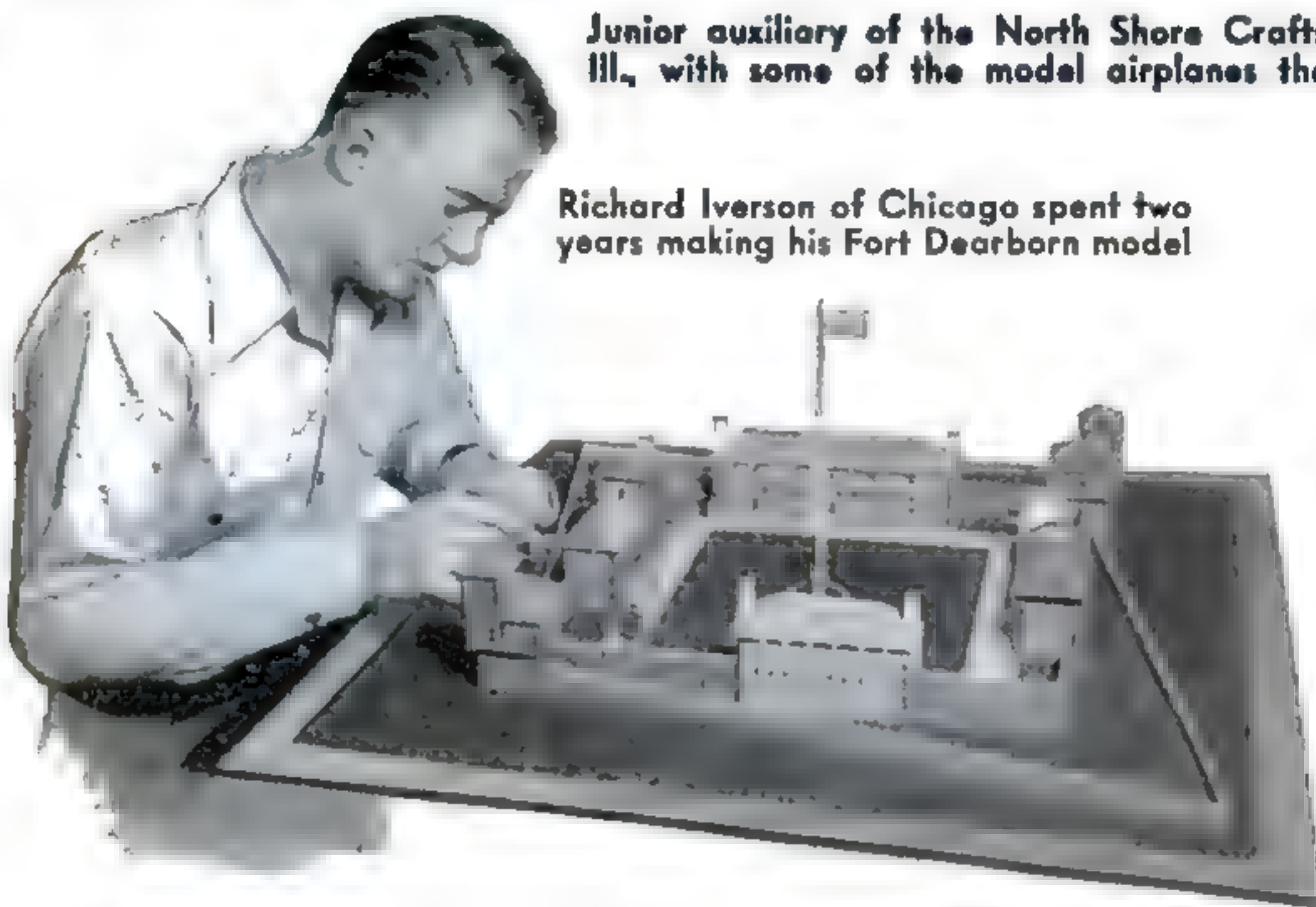
The Rev. L. Hadaway won the grand prize in the annual exhibition of the *Gales-*



Window display arranged by the Chesterfield Homeworkshop Club, one of eleven clubs located in Chicago, Ill.



Junior auxiliary of the North Shore Craftsman's Club, Waukegan, Ill., with some of the model airplanes the boys have constructed



Richard Iverson of Chicago spent two years making his Fort Dearborn model

burg (Ill.) Homeworkshop Club. He displayed a bed he had made. The judges were T. V. Brooking, C. R. Williams, and Miss Florence Belshaw, all of Galesburg High School. The show was held in the window of a local furniture company.

Boys between the ages of 8 and 18 have been organized into a model airplane club

by the North Shore Craftsman's Club, Waukegan, Ill. Several contests were recently won by the boys. There are two groups: the young boys meet on Saturday mornings and the older boys meet Wednesday nights.

Early last summer the Ashland (Ohio) Homeworkshop Club held a fish fry at the home of Joseph Massingill. The affair was so successful that the members decided to hold several more similar affairs and to invite their wives. At the first "Ladies Night" each member brought a small object he had made and the women drew lots for them.

THE COMRADERY OF CRAFTSMEN

Do YOU want to enjoy the fellowship of other amateur craftsmen? There is no better way to do it than to organize a home workshop club. Then you can meet regularly with them and exchange ideas, and enjoy the many free services available to home workers like yourself. Send a large (legal size), stamped, and self-addressed envelope to the National Homeworkshop Guild, 347 Fourth Avenue, New York.

A demonstration of a hand grinder was given before the *Crestline (Ohio)* Homeworkshop Club. "The Romance of Industry," a moving picture, was shown. An exhibition is planned for the fall.

Two instructive talks were given recently before the Gem City Homeworkshop Club, *Dayton, Ohio*. One was about the history of paint and methods of applying paint, and the other was about creosote.

Men of unusual talents belong to the *Salem (Ore.)* Homeworkshop Club. A. D. Jacobson, president, is an inventor and recently devised a crystal grinder for a local radio station. H. D. Robinette, vice president, has made many furniture pieces and at present is constructing a dining room set. I. C. Bishop, secretary, has established a local reputation for himself because of his beautiful inlaid pictures. Harry Hobson is internationally known among archers.

A model refrigeration plant that actually makes ice and automatically turns off and on has been constructed by Clarence Schneider, and was a

The Ashland (Ohio) Homeworkshop Club was entertained at a picnic by Joseph M. Massingill

feature of the annual exhibition of the *Preston (Ont., Canada)* Homecraft club.

Considerable publicity has been given in the local press to the Timbercraft Homeworkshop Club, *New Bedford, Mass.*, because of the honorable mention received in the annual achievement contest. President Charles Jeglinski says the club will make a determined effort to win next year's award . . . The Southeast Woodcraft Club, *Cleveland, Ohio*, is conducting a membership campaign. Kazimir Lasinis is in charge . . . The *Apollo (Pa.)* Homecraft Club is also having a membership campaign.



Annual exhibit of Galesburg (Ill.) Homeworkshop Club. The beds in the background won first prize

The Miniature Enlarger

ALTHOUGH BUILT FROM INEXPENSIVE MATERIALS, IT HAS

The complete enlarger with its transformer set on the baseboard near the upright



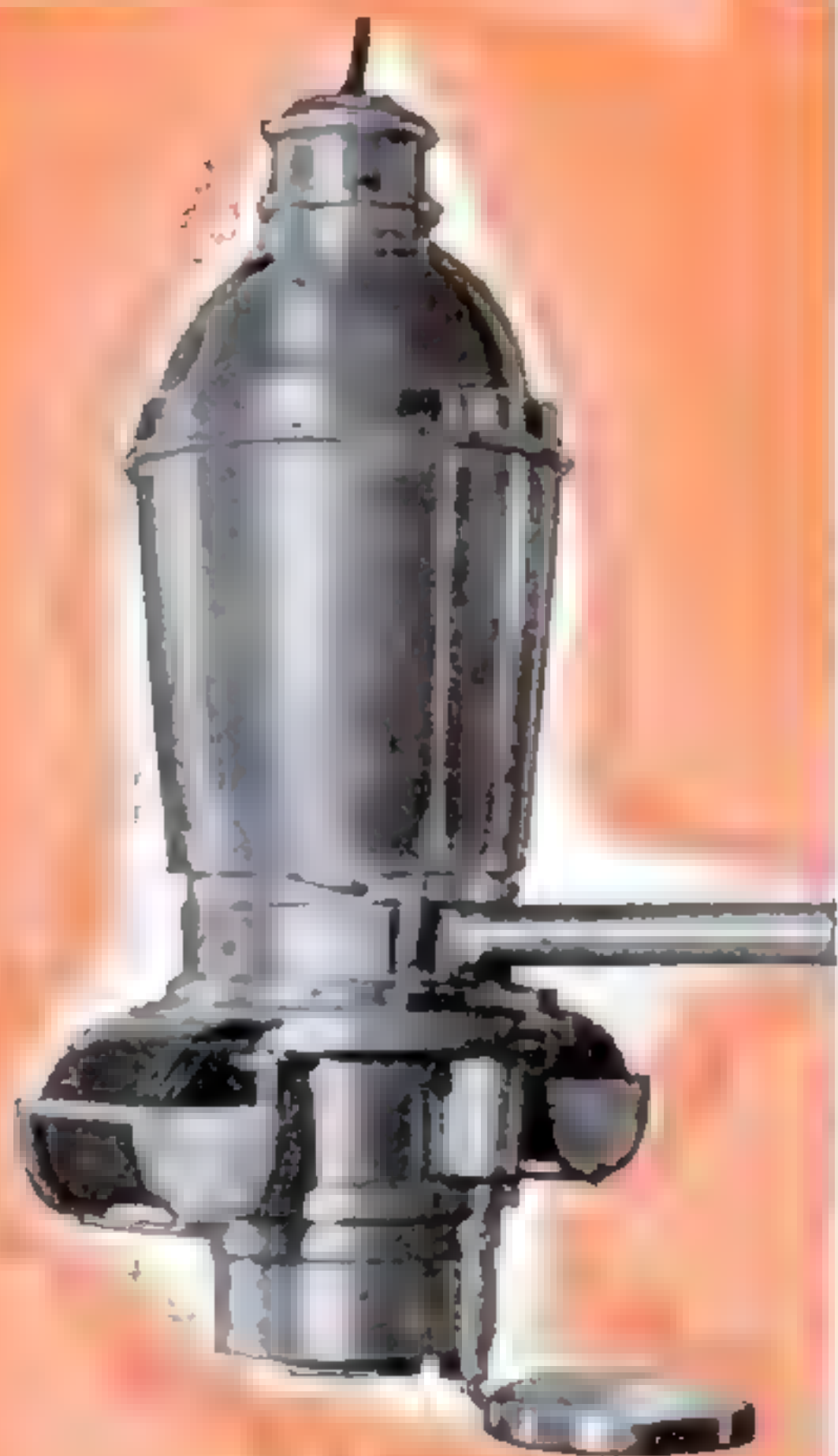
WHY IT'S A DE LUXE ENLARGER
Design is sturdy, compact, and unusually convenient.
Small bulb insures cool operation.
Special focusing mount gives critical focus with great ease.
Film emulsion guarded against dust and scratches.
Pilot light illuminates film when lower gate is dropped.
Has a telescoping arm so that big enlargements may be made on the floor.
Can be used as a projector for color transparencies.

By VIRGIL C. WILLIAMS

FEW miniature enlargers embody as many desirable features as the one illustrated, yet it cost only fourteen dollars for materials, including two condensing lenses. It is designed to take a regular camera lens of 2" focus. Obviously, those who wish to make a simpler and still less expensive miniature enlarger can eliminate some of the features and modify the construction to suit their purposes and the materials available.

For cool operation, an automobile headlight lamp, 6.3-volt, 50-candlepower, is used. A 6.3-volt, 5-ampere radio filament transformer supplies the power. The one used in the original enlarger has two sets of secondary terminals, one of which (6.3 volts) supplies current to the main bulb, and the other (5 volts) to a small pilot bulb of the type used for lighting radio dials.

The $\frac{3}{4}$ " five-ply veneer base is 18" by 21", cut as shown. The upright support is a 5" length of brass pipe welded to a $\frac{3}{8}$ " thick plate, which is bolted on the baseboard. The brass upright is $1\frac{5}{16}$ " in out-



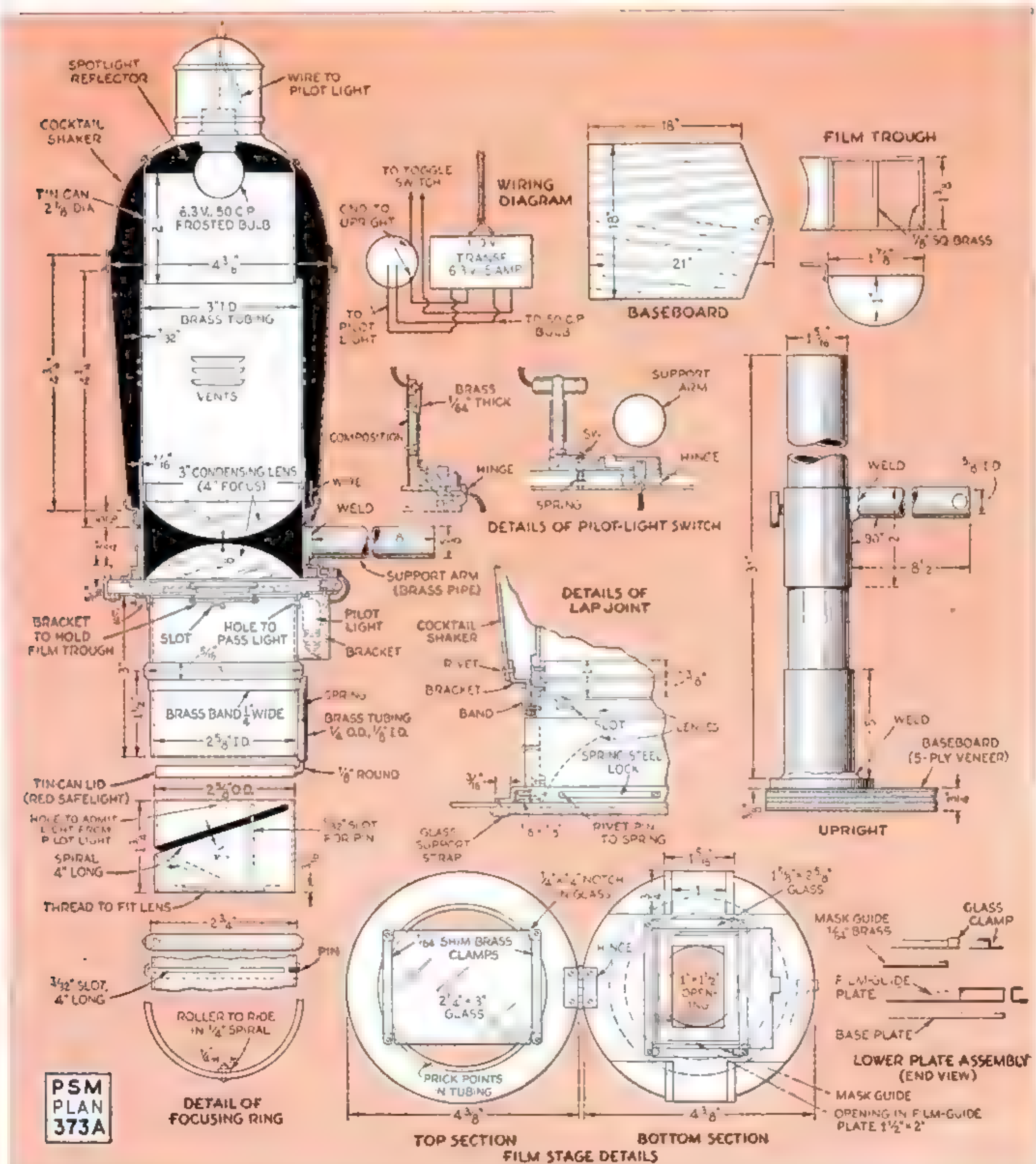
A quarter view from the rear showing the pilot-light housing and safe-light support

You've Dreamed of Owning

EVERY IMPROVEMENT A CAMERA ENTHUSIAST COULD ASK

side diameter and 31" long. Two wires from the transformer pass through the center of the pipe (the other side of the transformer winding being grounded as shown in the wiring diagram) and are soldered to a plug receptacle, which is insulated and forced into the end of the pipe.

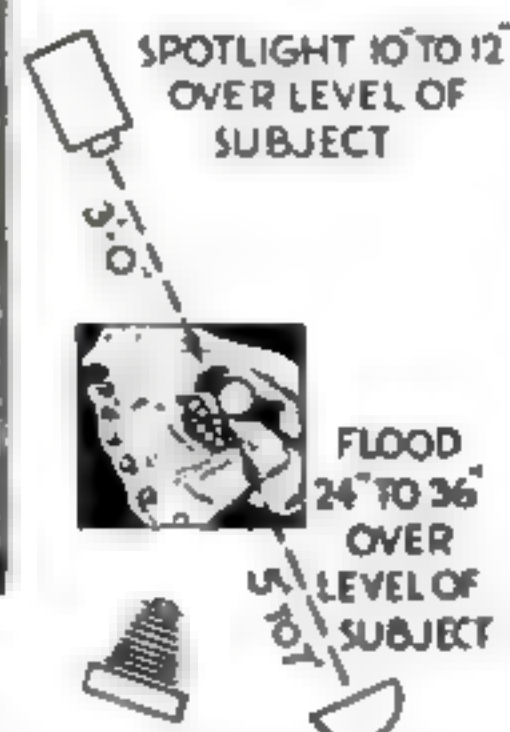
A 1-qt. cocktail shaker forms the outer housing. A salvaged spot light reflector is cut to 3" in diameter and fastened in the shaker lid along with a piece of tin can about 2" in length and of a size to fit inside 3" brass tubing. The bulb must be rubbed gently and uniformly with 00 sand-



LIGHTING FOR TEXTURE



The textures in this photo were brought out by setting up the lights as shown at right



POPULAR SCIENCE MONTHLY SHOP DATA FILE

[PHOTOGRAPHY]

THE dominant light should fall across the material so as to illuminate the parts that stand out in relief, but not the hollows. The secondary lamp is then used to illuminate the hollows, thus avoiding coal-black shadows. For special effects, as when a dramatic picture of great contrast is desired, the secondary light may be omitted.

paper to frost it. Paint the reflector black because it is not focused for such a short distance.

For the inner housing, a piece of brass tubing is used, 3" in diameter, 1/16" wall, 4 1/2" long. The lower section is of the same tubing about 1 1/2" long; this depends on the size of the lower condensing lens. A lap joint is made by turning the inside of the upper and the outside of the lower section to 1/32" thickness by 5/16" deep. The outside of the upper tubing is turned to a 1/32" wall about 3 1/2" down. Then cut three slots with a hack saw in four sets about 1 1/2" from the top, and bend out for ventilators.

Rivet four clips to bottom of shaker housing. Make an aluminum band as wide as the legs of the clips (about 5/16") to extend the circumference. Slip outer housing down over inner tubing and place the band around, as shown. Set upper housing on lower and drill through each clip. Tap the band, clip, and inner housing, and on lower tubing make L-shaped slots. Insert screws to extend about 1/16" on inside. The upper housing should now slip down over the lower section and lock in place with a slight turn.

To support the housing, make a band of 1/16" by 3/4" brass, weld together, and weld on a piece of 5/8" pipe, 8" long.

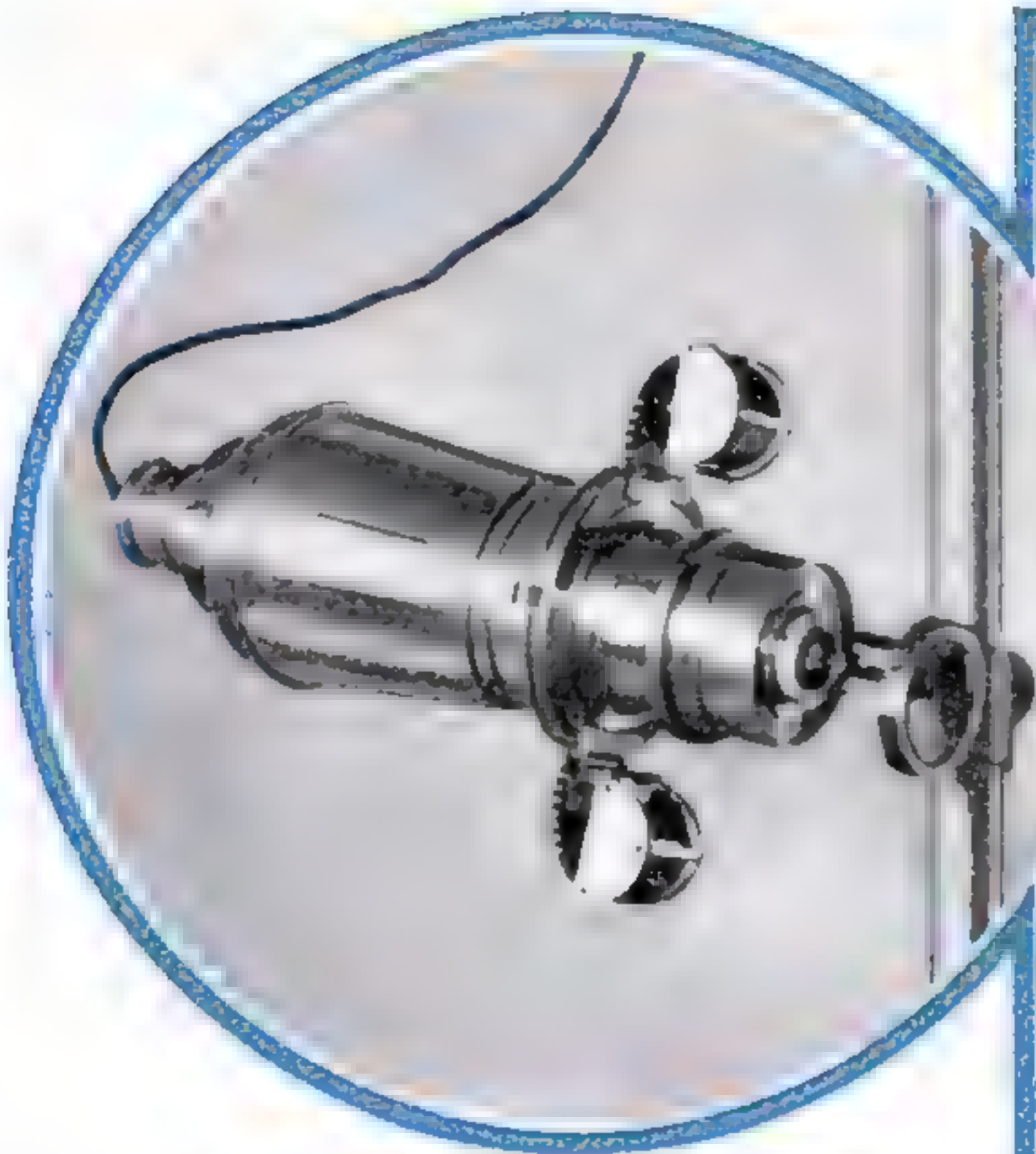
A ring 1/8" square in section is next turned to fit outside of tubing. Fasten it about 1/16" up from bottom. Make a flange ring to fit over this for fastening to the upper horizontal plate.

Imported condensing lenses of 3" diameter and 4" focus, obtained from a motion

picture or photo supply house, are used. Prick-punch bottom of tubing wall about 1/4" apart to support the lower one. Set the upper one with two bands of brass so that the peak of convexity is even with the lower part of the upper housing. Use another band to hold in the lower lens. Do not force



The gate swings down to give access to the film, and a pilot lamp lights up for perfect visibility

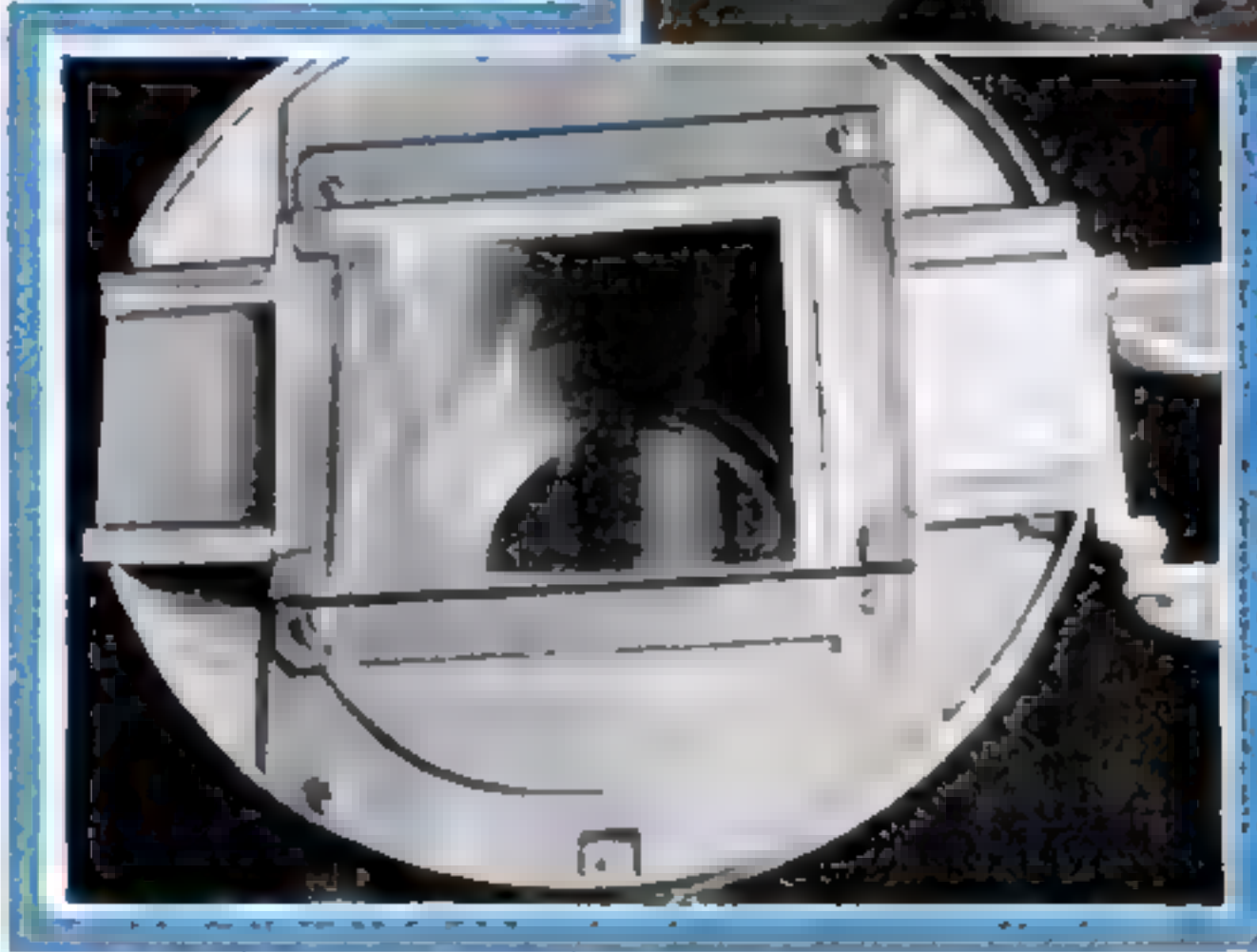


The enlarger turned for projecting color transparencies

either lens; instead, draw the edge over sandpaper if necessary until the lens fits the tube. Be sure the flat sides of the lenses are parallel and set square in the enlarger or distortion will result.

The upper and lower horizontal plates are $\frac{1}{16}$ " thick brass, $4\frac{3}{8}$ " in diameter. A hole is turned in upper plate a free fit on tubing. A piece of optically clear, double-thick glass, $2\frac{1}{4}$ " by 3" with $\frac{1}{4}$ " notches in the four corners, is fastened in with $\frac{1}{64}$ " brass straps about $\frac{1}{4}$ " wide. The screws pass through straps and plate and into threaded holes in the flange ring. A 3" length of clock spring is fastened to flange ring; and a pin is riveted into the other end, and a hole drilled through the flange ring into the $\frac{1}{8}$ " square ring. The riveted pin in the spring drops into the square ring to lock the upper plate. This flange ring enables the bottom section to rotate around the tubing so that pictures can be projected upright.

The lower horizontal plate is the same diameter as upper, but the center hole is $2\frac{3}{4}$ " in diameter. A plate of $\frac{1}{64}$ " brass is made to cover the entire area and turned up on each side to form film slides. These slides are not quite as wide as the film to cause the film to cup up in the center so



The lower gate with mask inserted. The film slides are adjusted so only the edges of the film touch anything until gate is closed

Another view of the lower gate without the mask. The glass is fastened in with small brass clamps

that the emulsion does not touch the glass plate until the gate is closed. A hole $1\frac{1}{2}$ " by 2" is cut in center of this plate. Another $\frac{1}{64}$ " brass piece is made to fit over this opening and turned over on each side and back for a mask guide. This piece is $1\frac{3}{4}$ " by $2\frac{1}{4}$ " outside before turning the edge, with a $1\frac{1}{2}$ " by 2" opening in the center. Another flawless piece of glass $1\frac{5}{8}$ " by $2\frac{5}{8}$ " is placed over these plates and fastened with brass clamps, the screws passing through the lower plate into the angle ring.

Place a film between the two glass plates, fasten a hinge to upper plate, and shim up on lower plate. Make a strip of $\frac{1}{64}$ " brass as wide as the distance between plates and rivet onto the lower plate, but cut out on each side for film slides and in back for the hinge. Rivet this on to stop stray light. Metal masks to slide under lower piece of

glass may be cut from thin sheets of brass.

Turn an angle ring of $2\frac{3}{4}$ " inside diameter to take the focusing tube, which fits inside the angle ring and is flush with inner surface of lower plate. Cut four L-slots in ring and rivet four pins into the focusing tubing. The inner tubing will have to be dressed on the lathe with a file to fit inside the outer tubing. Both pieces are $\frac{1}{16}$ " wall. A slot is cut in the outer tubing about $\frac{3}{32}$ " wide, 4" long, and $1\frac{1}{2}$ " up from bottom.

Make a ring about $\frac{5}{16}$ " wide by 3" outside and $2\frac{3}{4}$ " inside diameter. Groove out center, inside, about $\frac{3}{32}$ " wide and deep. Make a band of $\frac{1}{32}$ " brass about $\frac{1}{4}$ " wide to go around outside of lower tubing. The focusing ring rides on top of the lower band and is placed so the focusing ring groove falls in line with the slot in outer tubing.

The inner tubing requires a spiral slot, $\frac{1}{4}$ " wide and 4" long, starting about $\frac{1}{8}$ " from top and running to about $\frac{3}{16}$ " from bottom. An additional $\frac{3}{32}$ " vertical slot in back of the inner tubing is required for a stabilizer pin; it starts $\frac{1}{8}$ " from top and extends to within $\frac{3}{16}$ " of bottom. Drill through back of outer tubing and insert a screw at top of vertical cut. Make a roller to ride in spiral on inside. Finally, turn a piece of brass to fit in bottom of inner tubing to take the lens to be used. This mount will work only with a lens of 2" focus.

The remaining details are made as shown in the drawings. Note that the safe light is mounted on a rod with a small pin to engage a bayonet slot so that it will lock either open or under the lens.

The pilot light is fastened in its housing with a clip. A wire is soldered to bottom of

bulb and led out through a hole in back. A $\frac{5}{8}$ " hole must be drilled through the angle ring, outer focusing tube, and inner tubing to allow light to pass and strike the glass. The wire from the pilot light is connected by a small hinge to brass connections mounted on a piece of composition on back of enlarger. Two breaks have to be made in the circuit—one so the light housing may be removed, the other to allow the lower plates to revolve. A small switch is made so that when the lower gate drops, the circuit is closed.

Removable film troughs are of $\frac{1}{8}$ " square brass rod, $1\frac{3}{8}$ " wide and $1\frac{3}{4}$ " long, with flange at end to fit on each side of enlarger gate. When troughs are riveted together, a piece of aluminum is riveted on each side.

The supporting arm is in two pieces. One is $\frac{5}{8}$ " outside diameter by 8"; the other is $\frac{5}{8}$ " inside diameter and $8\frac{1}{2}$ " long. The latter is welded to a piece of pipe that fits snugly over the upright pipe. After the enlarger has been carefully squared with the base, a small thumb screw is placed in the end of the outer pipe and a hole drilled part way into the inner pipe.

Machine screws of the 2-56 size are used throughout, and holes are tapped instead of using nuts. All rivets are escutcheon pins. Solder is avoided as much as possible.

The cost of building the original model was about \$14, as follows: condenser lenses, \$2 each; transformer, \$3.50; brass upright, tubing, arms, etc., \$4.95; cocktail shaker, 60 cents; spotlight reflector (salvage), 20 cents; light bulbs, 40 cents; baseboard, 35 cents. I did my own machine work and welding.

Marked Tape Gives Scale for Technical Photos



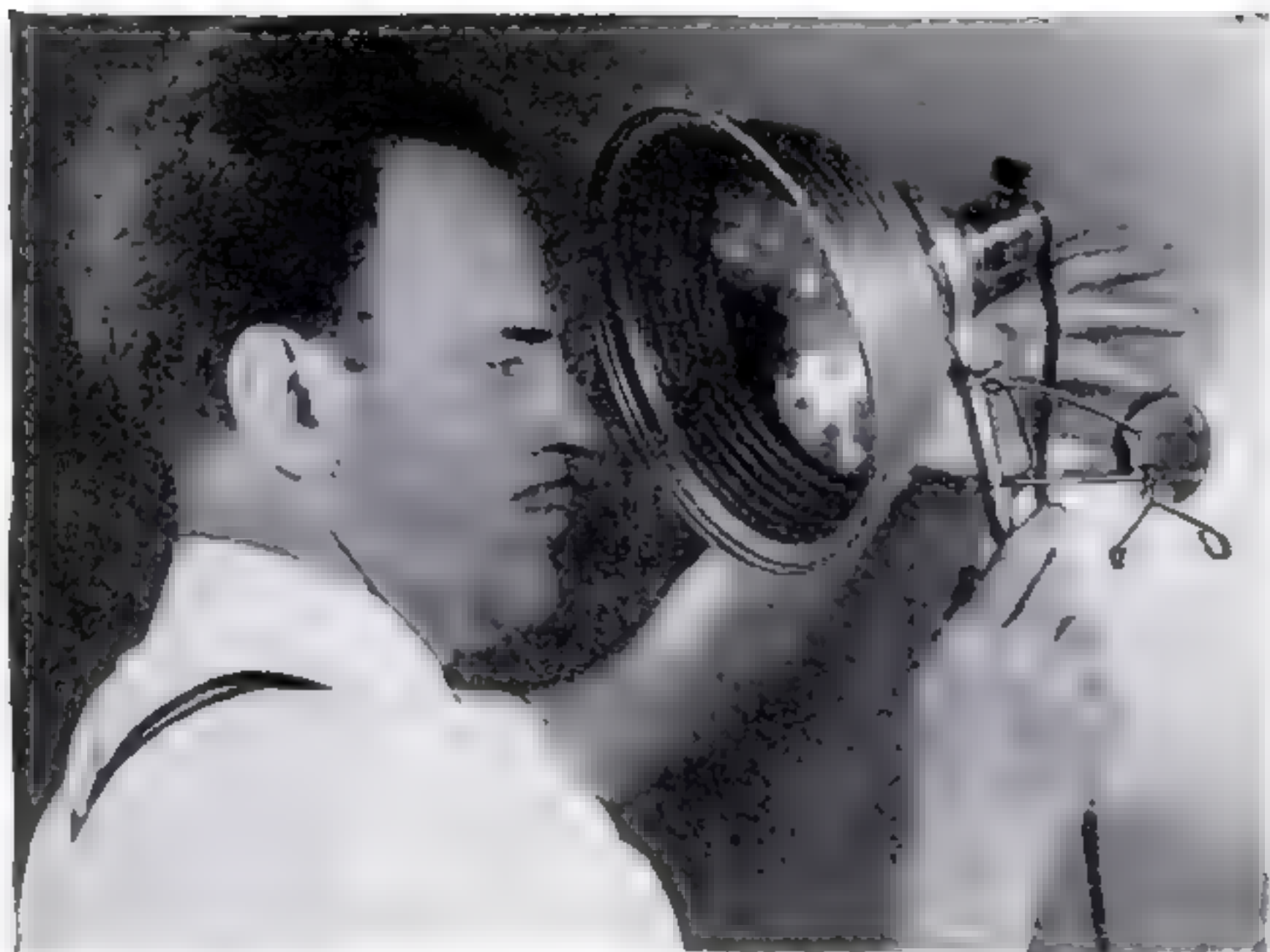
Adhesive paper tape, if marked off into inches, may be used to provide a scale for photographed objects. It can be stripped off without harm and used again and again

PHOTOGRAPHIC records of technical objects are more valuable if they include a scale to indicate the size of the various parts. This is especially important when the photographs are to be used later as a guide to construction.

A simple way to provide such a scale is to draw lines with black drawing ink at 1" intervals on a



length of adhesive paper tape, such as masking tape or drafting tape, and mark every twelfth line with double lines. The tape is then used as shown. If necessary, it can be placed on curved surfaces, and in some instances it might even be desirable to use transparent tape.—
ROLF C. HAFERL.



Suction Cup Holds Lamp on Wall

tional lamp stand, which is somewhat cumbersome and not always high enough to throw the light down at the desired angle.

A piece of stiff wire, such as may be obtained from a discarded coat hanger, is run through the hole in the suction cup and then bent approximately as shown. Note that there are two legs which bear against the wall and prevent sagging. At the outer end of the wire bracket are two eyes bent to fit a short piece of brass tubing. A strip of metal about 1/2" wide is bent around the base of the reflector and attached to the tubing with

a bolt and wing nut so that the lamp may be tilted up or down or swung around as desired after the suction cup has been moistened and pressed in place against the wall.—FRANK CAPORAE.

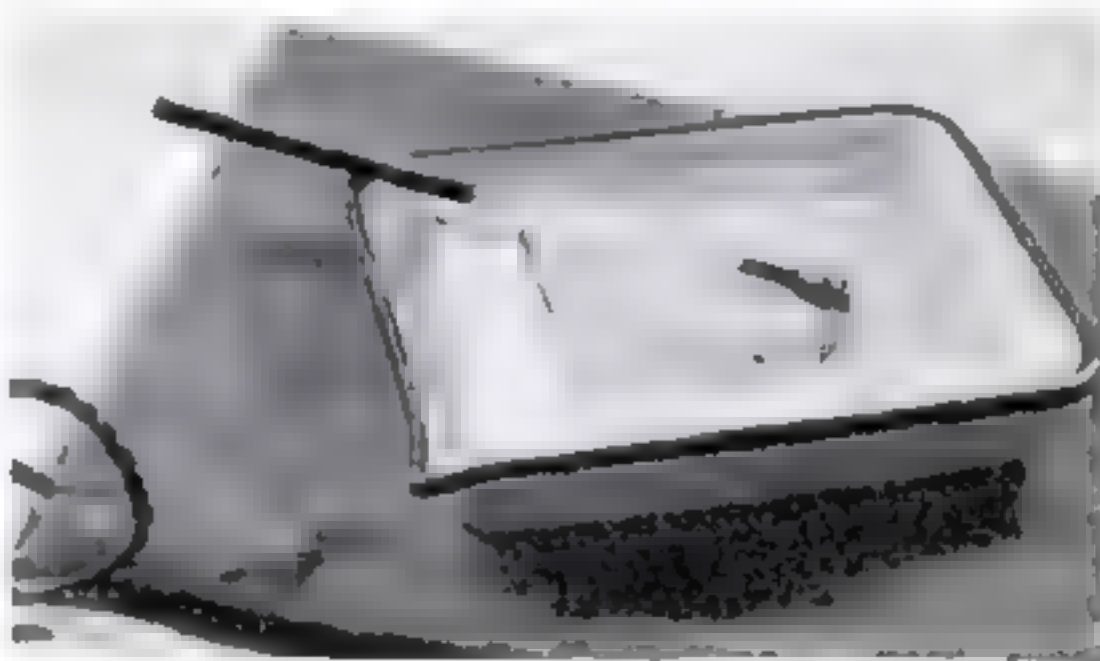
If attached to a common suction cup in this way, a photo lamp may be fastened instantly to any flat, smooth wall or ceiling

A HEAVY suction cup from a coat hook of the type sold in ten-cent stores may be used for supporting a photographic light on any flat, smooth wall or ceiling. This is often more convenient than using a conven-

a bolt and wing nut so that the lamp may be tilted up or down or swung around as desired after the suction cup has been moistened and pressed in place against the wall.—FRANK CAPORAE.

Heating Pad Warms Developer

PLACED under a developing tray, an electric heating pad will keep the solution at the desired temperature in a cold darkroom. Unless the pad is waterproof, lay several sheets of paper or a piece of oilcloth over it. A thermometer should be kept in the tray as a check on the temperature, which is easily regulated if the pad is of the variable type.—RAY KERSHNER.



EMULSION RATING VALUES				[PHOTOGRAPHY]	
Film	Weston Speeds	American Scheiner Speeds	Day Tung.	Day Tung.	
ROLLS AND PACKS					
Agfa					
Superpan Press	100	28	29	28	
Plenachrome	24	21	24	21	
Superpan	24	23	24	23	
Eastman					
Super XX	100	28	29	28	
Verichrome	24	21	24	21	
Panatomic X	24	22	24	22	
N. C.	12	18	23	18	
MINIATURE					
Agfa					
Ultra Speed Pan	100	27	29	27	
F. G. Plenachrome	24	21	24	21	
Finopan	24	23	24	23	
Dupont					
Superior	24	21	24	21	
Micropan	6	13	15	13	
Eastman					
Super XX	100	27	29	27	
Plus X	50	24	26	24	
Super X	24	23	25	23	
Panatomic X	24	22	24	22	
PORTRAIT AND COMMERCIAL					
Agfa					
Triple S Pan	100	27	28	27	
Isopan	50	24	25	24	
S. S. Pan	24	23	24	23	
Superpan Portrait	24	23	24	23	
S. S. Plena	24	24	26	24	
Commercial Pan	24	21	22	21	
Portrait	12	17	20	17	
Commercial Ortho	12	19	21	19	
Commercial	12	15	20	15	
Eastman					
S. S. Ortho Port.	24	23	26	23	
S. S. Pan	24	25	26	25	
Portrait Pan	24	24	26	24	
Commercial Pan	24	21	24	21	
Par Speed Port.	24	20	25	20	
Panatomic X	24	23	24	23	
Commercial Ortho	12	19	24	19	
Commercial	12	17	23	17	
PRESS					
Agfa					
Superpan Press	100	28	29	28	
Super Plena Press	100	24	28	24	
Eastman					
Super Panchro Press	100	28	29	28	
Ortho Press	50	22	25	22	

NOTE: Weston ratings published by agreement with Weston Electric Instrument Corporation. Scheiner speeds supplied by Photo Utilities, Inc.

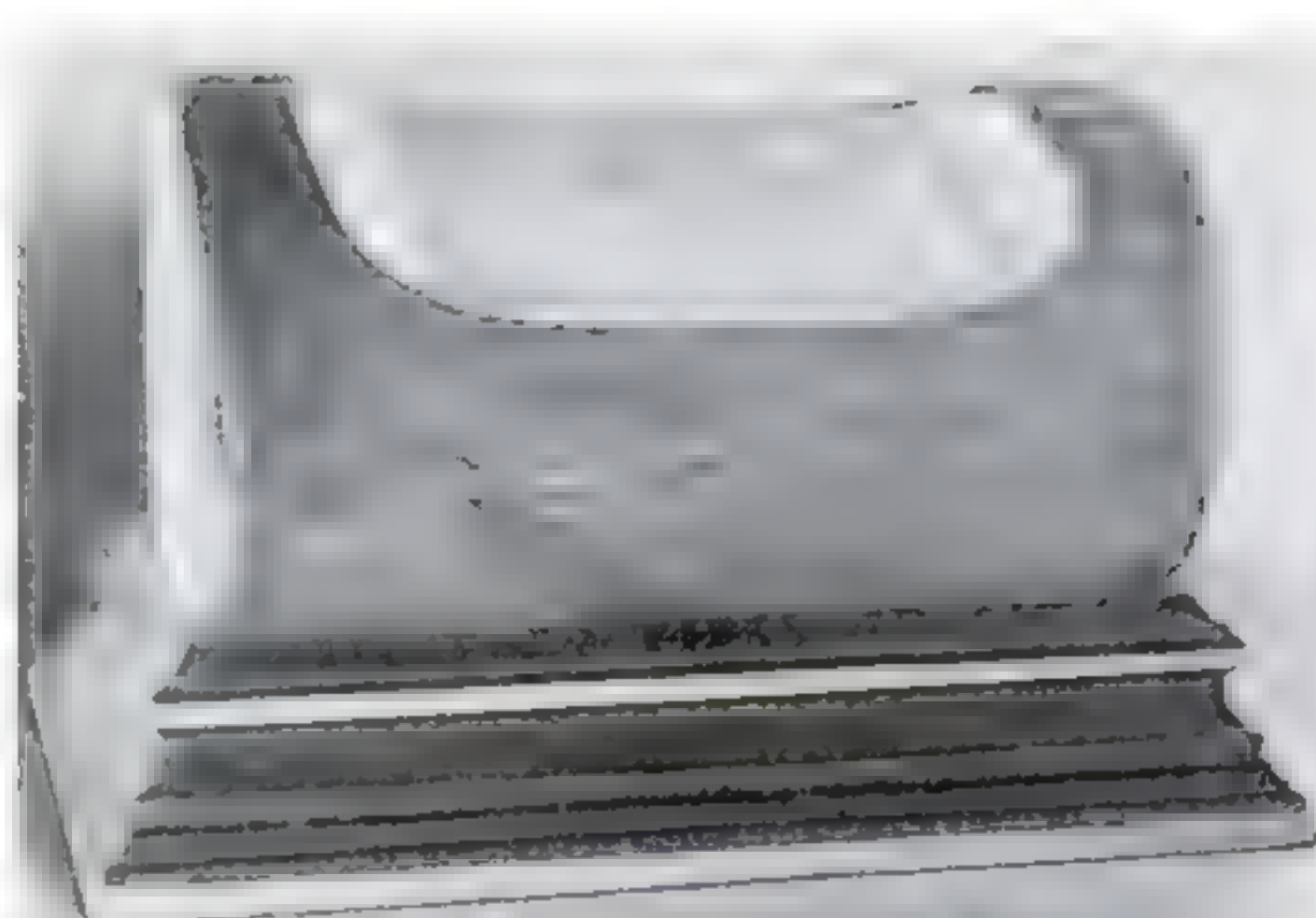
Mounted Logs Serve as Inexpensive Trophies

TROPHIES that are suitable for many kinds of awards can be made from sections of a log about 9" long and 5" wide. Northern white cedar was used for the trophy illustrated, but elm, maple, ironwood, oak, and other woods have also been used. Avoid any with scaly or flaky bark.

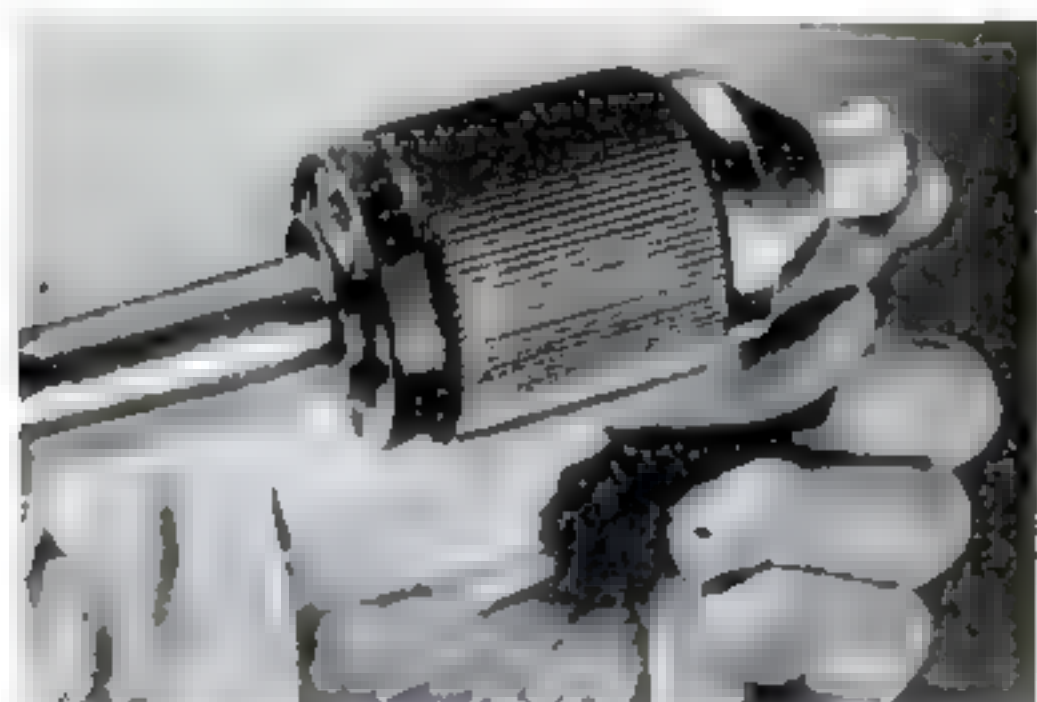
Saw off the ends to expose the clear surface and round them slightly. Cut out a portion 1" deep as shown, sloping slightly downward so that the wording can be read easily. An old picture frame was used to make the base illustrated; it is 2" high and extends 1" beyond the log. Plane the bottom of the log until the width equals that of the base.

After the ends of the log have been sanded, apply a coat of equal parts of turpentine and linseed oil on the exposed surfaces. Follow with a thin coat of white shellac and two coats of varnish, and rub down the cut ends

The inscribed card may be attached when the varnish is tacky or it may be applied later on with glue



of the log after each coat. The base is given two coats of flat black and a gold stripe is added at the very bottom and on one of the beads near the top of the base. Glue felt on the bottom.—H. G. PETERSON.

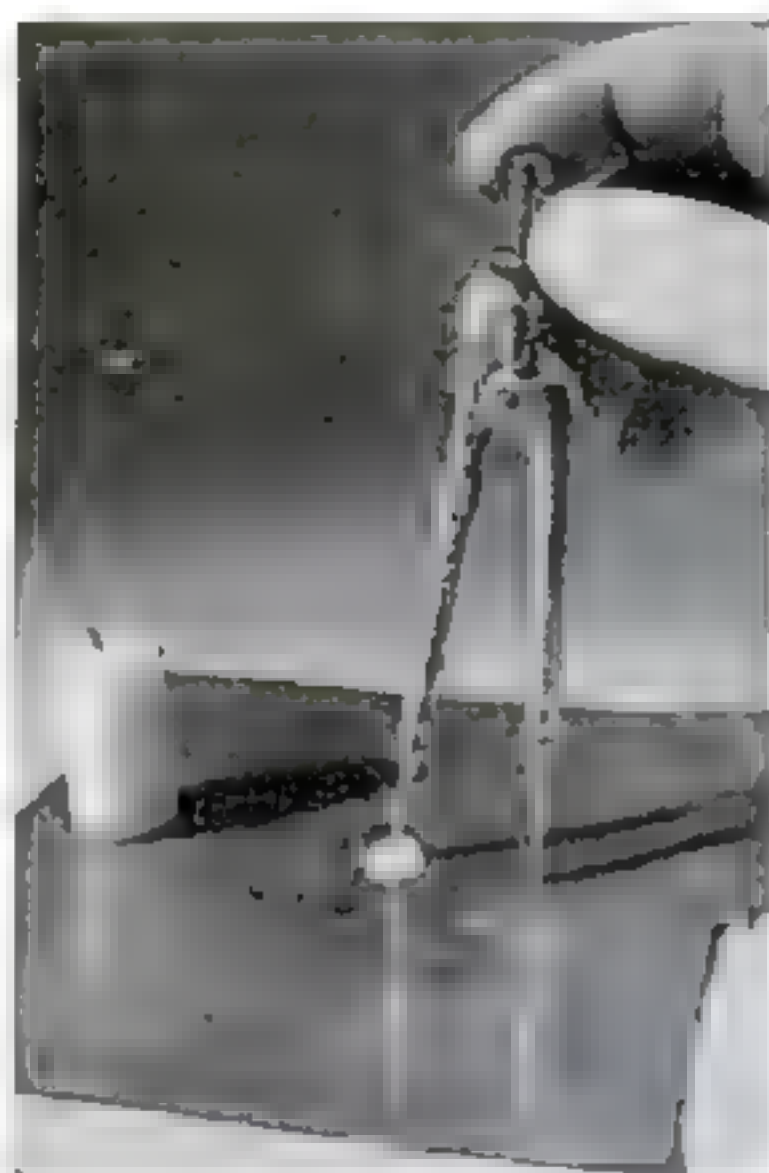


Corks Keep Dirt from Chucks

AN ORDINARY bottle cork will protect small chucks from dirt and dust when they are not in use, especially the more accurate chucks used on drill presses and lathes. It is a good idea to fill a chuck occasionally with light machine oil, cork it, leave it overnight, and then pour out the oil the next day. This will keep it well lubricated.—H.R.H.

Scribing Circles with Compass on Sheet Metal

WHEN it is necessary to scribe a circle on sheet metal, a small pool of wax from a candle will hold the compass point securely without marring the surface. By this method it is possible to avoid making a prick-punch mark.—A.B.



Thumb Tacks Stop Drawer from Sagging at End

SOMETIMES the fronts of bureau or desk drawers stick badly because of wear or sagging of the drawer runs. The weight of the drawer, when it has been pushed all the way in, makes the back end drop from the horizontal, and this causes the drawer front to tilt slightly and bind. A simple remedy in most cases is to insert a polished steel thumb tack under each side of the drawer about 3" from the back. The tacks hold the drawer on an even keel.



Below, pouring the hot gelatin into the pans. When it has set, it is ready for use. Left, peeling a copy from the hectograph



DOUBLE-SURFACED Hectograph

SPEEDS UP DUPLICATION WORK

MADE with two gelatin surfaces, this hectograph or duplicator may be stored away free from dust, and the work also may be speeded up because two copies can be run off at the same time.

The frames are $\frac{1}{2}$ " oak strips glued to pieces of three-ply $\frac{1}{4}$ " veneer. The inner edges are beveled to lock the gelatin in the wooden pan. Hinge the frames together and provide a hook and eye or other locking device.

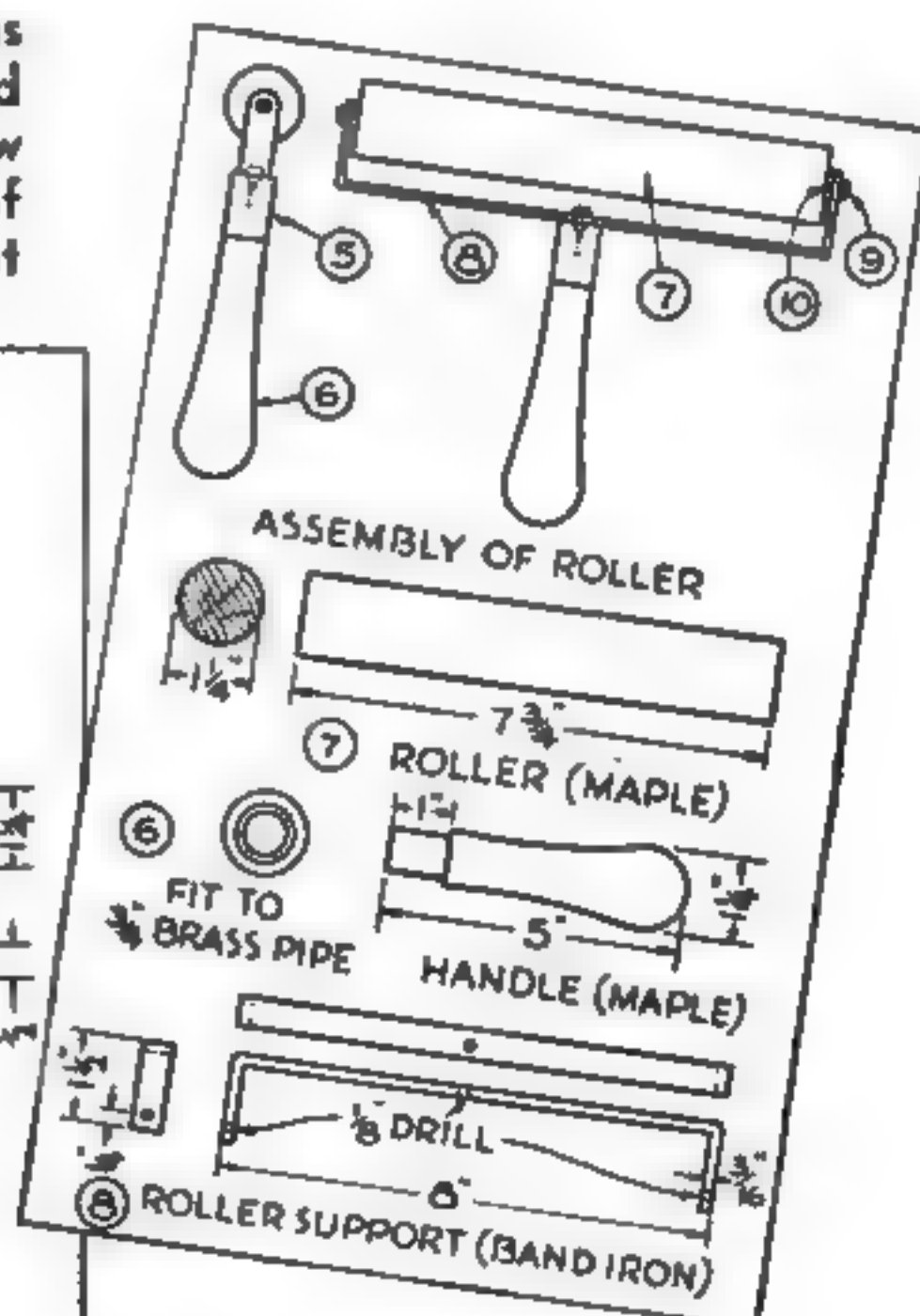
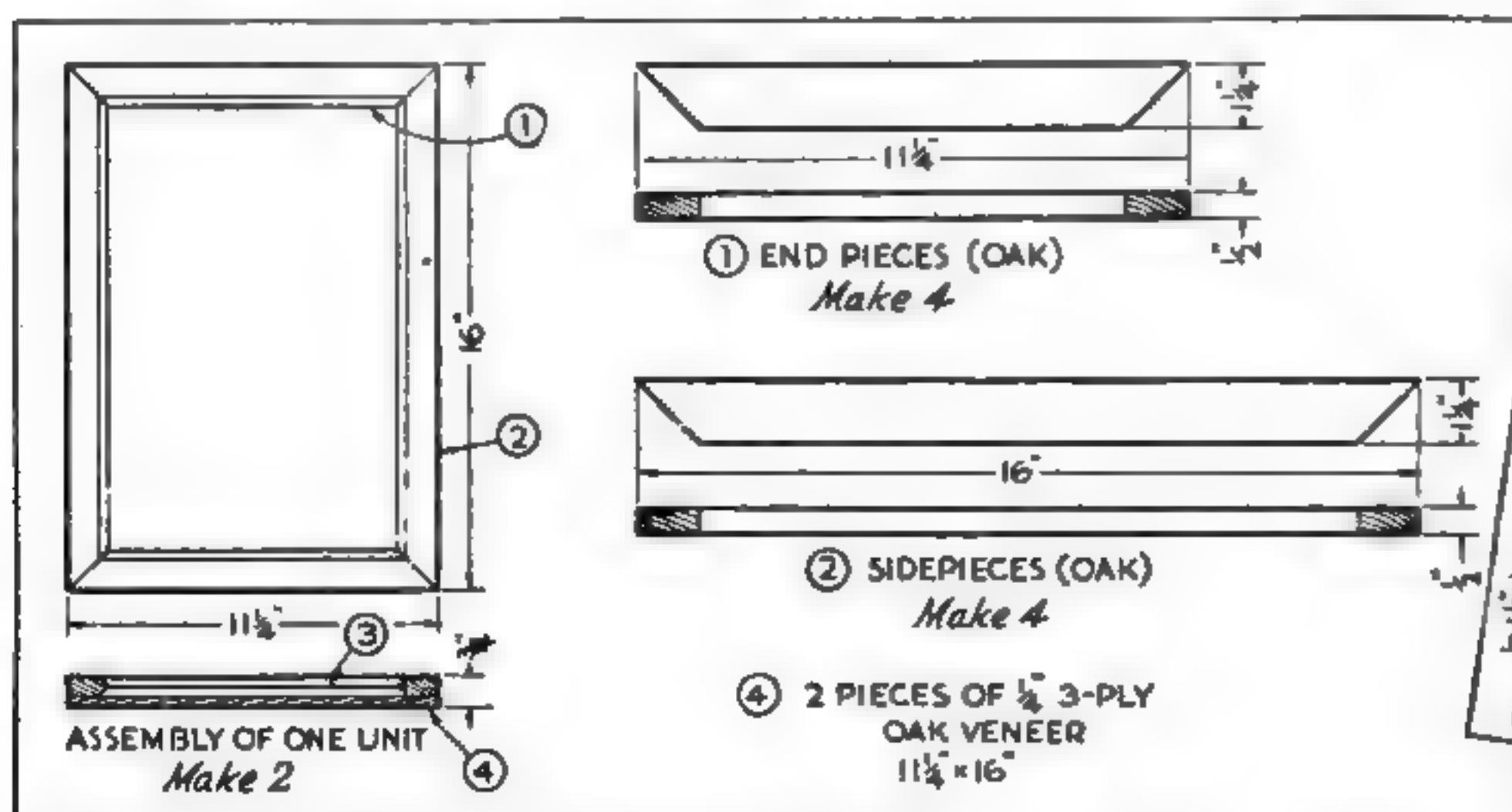
Gelatin compositions ready for heating and pouring into the pans are sold by large stationers and mail-order houses. However, if you wish to make your own, the following formula will be found satisfactory: 6 oz. glue, 12 oz. water, and 24 oz. glycerin (all by weight). Soak the glue in the water until it forms a jelly, then add the glycerin and heat in a double boiler. If the glue is not clean, strain the mixture. Before pouring this into pans, see that the frames are placed level on a solid surface. After pour-

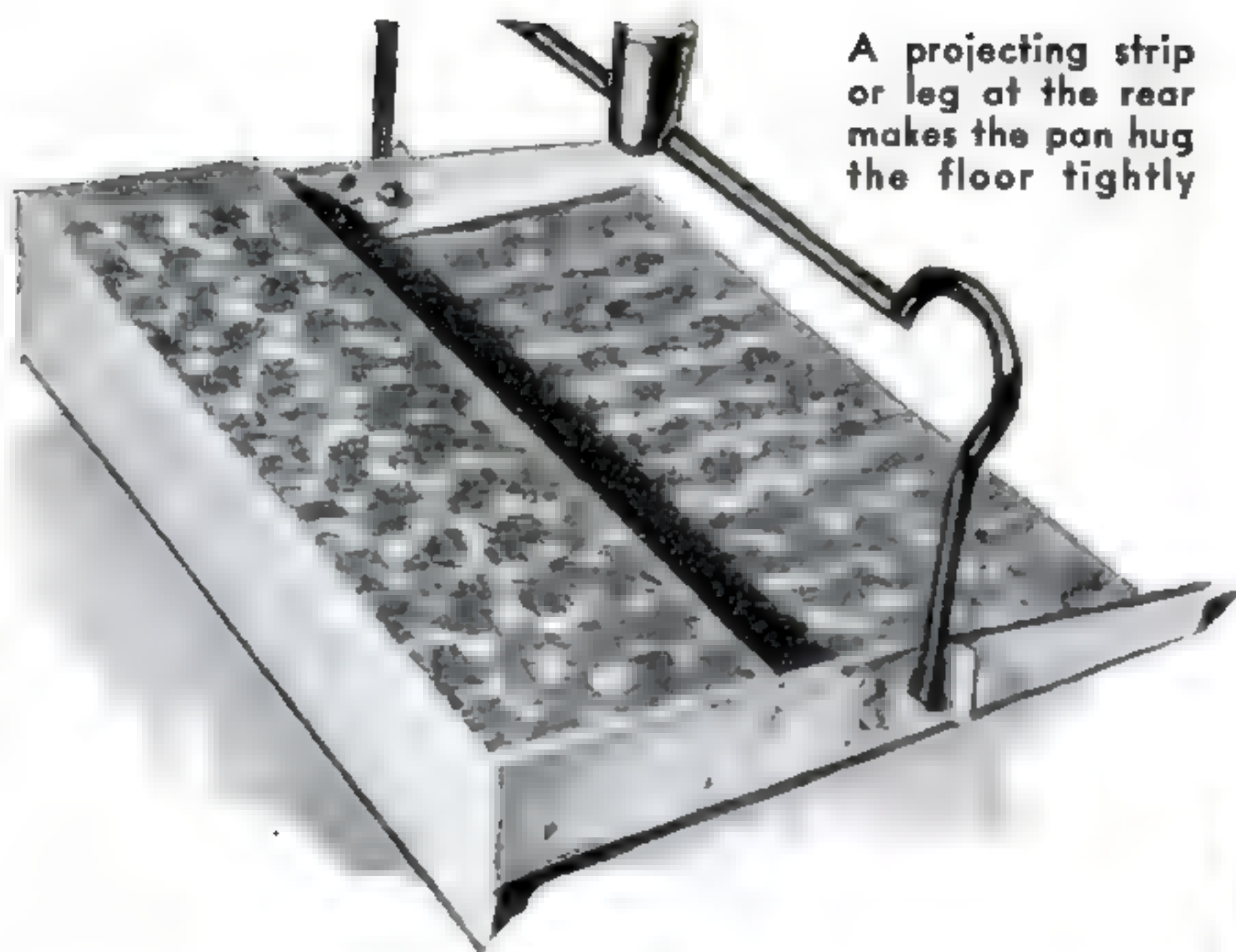
ing, skim the surface with a piece of cardboard to remove air bubbles.

To prepare the master copy, a special hectograph ink must be used. The master copy is placed on the gelatin and pressed down tightly with a wooden or rubber roller. If possible, leave one corner of the master and all other copies loose so that it may easily be taken hold of. After the copy has been in place a few minutes, pull it slowly from the pad.

After making the last copy, wash off as much ink as possible. The remainder will soon soak in. To renew the smoothness of the gelatin at any time, coat with a little alcohol and ignite.—EDMUND C. HANLEY.

Detail drawings of roller and pans. Note how inner edges of frames are cut



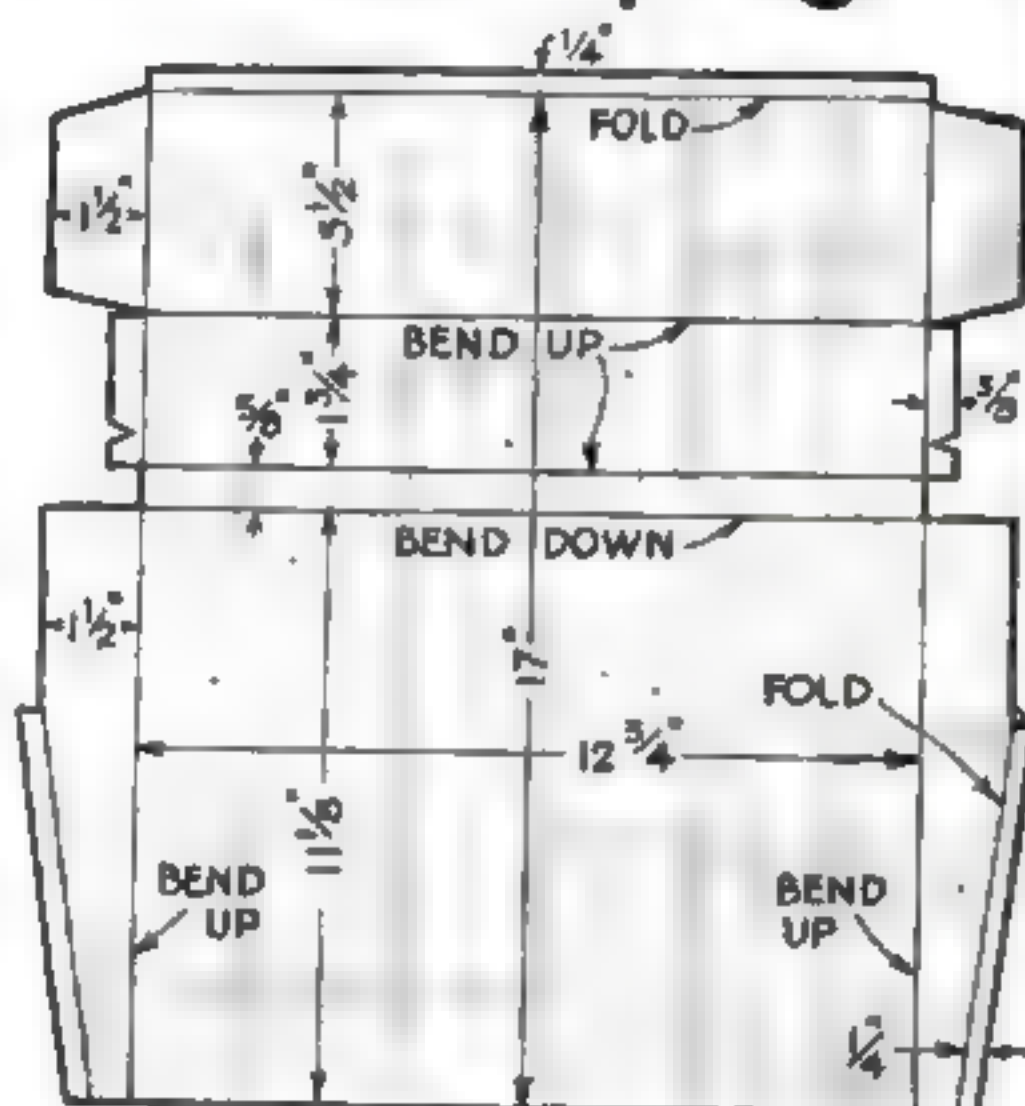


A projecting strip or leg at the rear makes the pan hug the floor tightly

Long-Handled Dustpan Saves Housewife from Stooping

NO STOOPING is necessary with this handy nontipping dustpan which is made of 26-gauge galvanized iron and a handle taken from an old carpet sweeper. The metal is cut and bent as indicated. The top and side edges are rolled back for a smooth finish. The long top-piece is bent down on either side and secured with rivets to the sides of the pan.

Small L-shaped stop pieces are riveted to the sides to hold the dustpan at the proper angle. When the pan is picked up, they prevent the bed tipping up to the handle, which would make it awkward to place on the floor again; and they also prevent the han-



How the dustpan is used and, at left, a pattern to aid in cutting out the metal

dle falling forward to the floor. Holes are drilled through pan and stop pieces to receive the handle. The $\frac{5}{8}$ " projection that is bent down at the back to form a leg is for the purpose of tipping the bed of the pan slightly so dirt goes into and not underneath the pan.—BENEDICT BRONSON.



Nonskid Facing Improves Miter Gauge on Saw

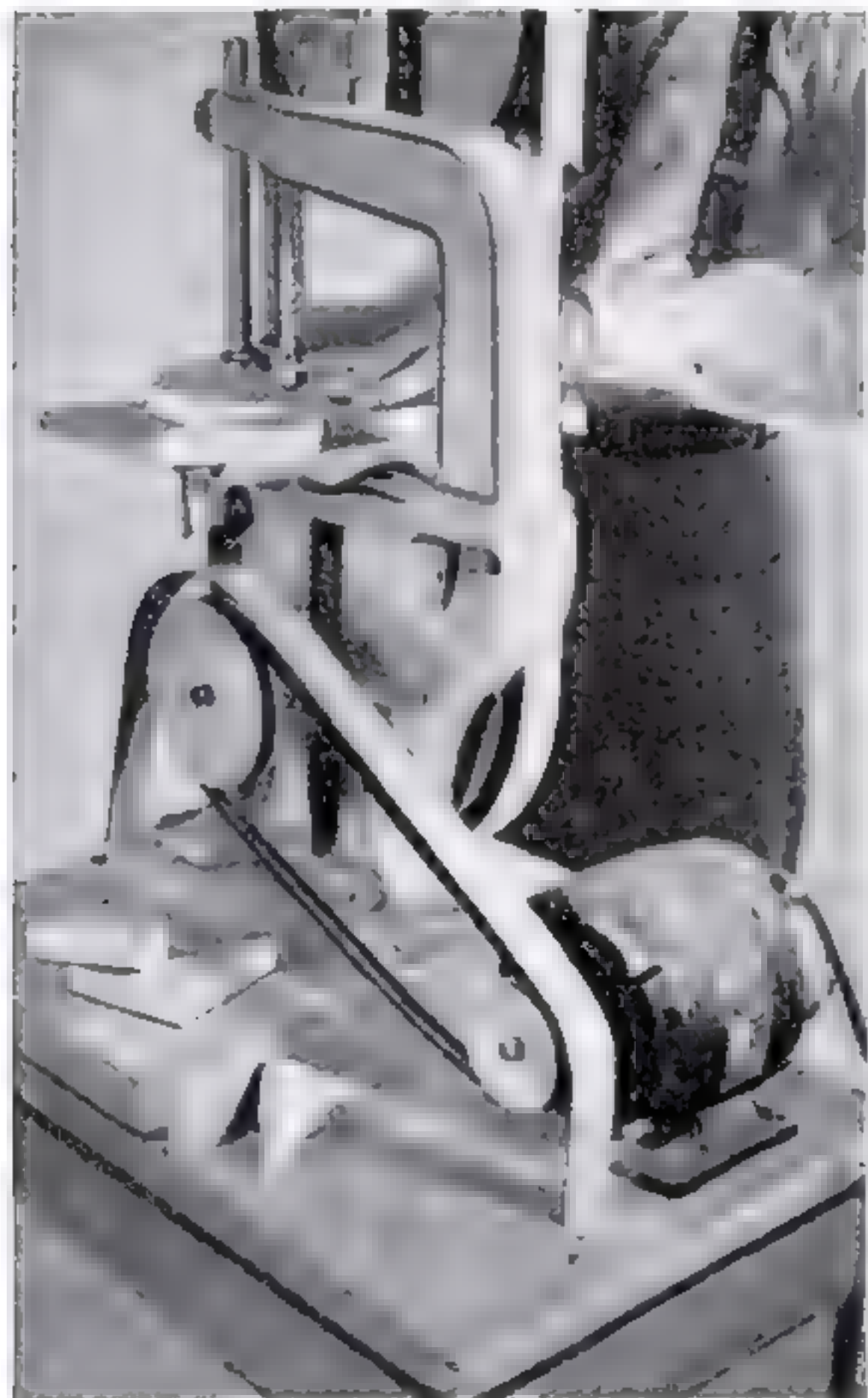
NONSKID rug lining of the cork variety makes an excellent covering for the wood facing on the miter gauge of a circular saw. It is attached to the wood with rubber cement. The stock to be sawed has no tendency to slip when it is held against the rug lining. This material is also useful for cementing underneath book ends, clocks, and lamps to keep them from marring table tops and also to prevent them from sliding.

Rip Fence of Saw Inverted under Table When Not in Use

WHEN not in use, the ripping fence on a circular saw table of the type illustrated can be inverted so that it will slide back on the underside of the guide bars. It is then entirely out of the way, yet instantly available. This is better than standing it in a corner or placing it on the floor of the shop, which is so often done.—K. M.

Band-Saw Belt Guarded to Prevent Accidents

THE danger that waste pieces will fall from a band-saw table and come in contact with the belt may be overcome by making a guard as shown below. Strap iron $1/16$ " thick and $1\frac{1}{4}$ " wide is bent to conform to the belt and pulleys, allowing about 1" clearance, and fastened to the bench top or metal stand with screws or bolts.



If no belt guard has been provided for a small band saw, one can be bent from strap iron to fit over pulleys and belt. It is fastened to the bench or stand at each end

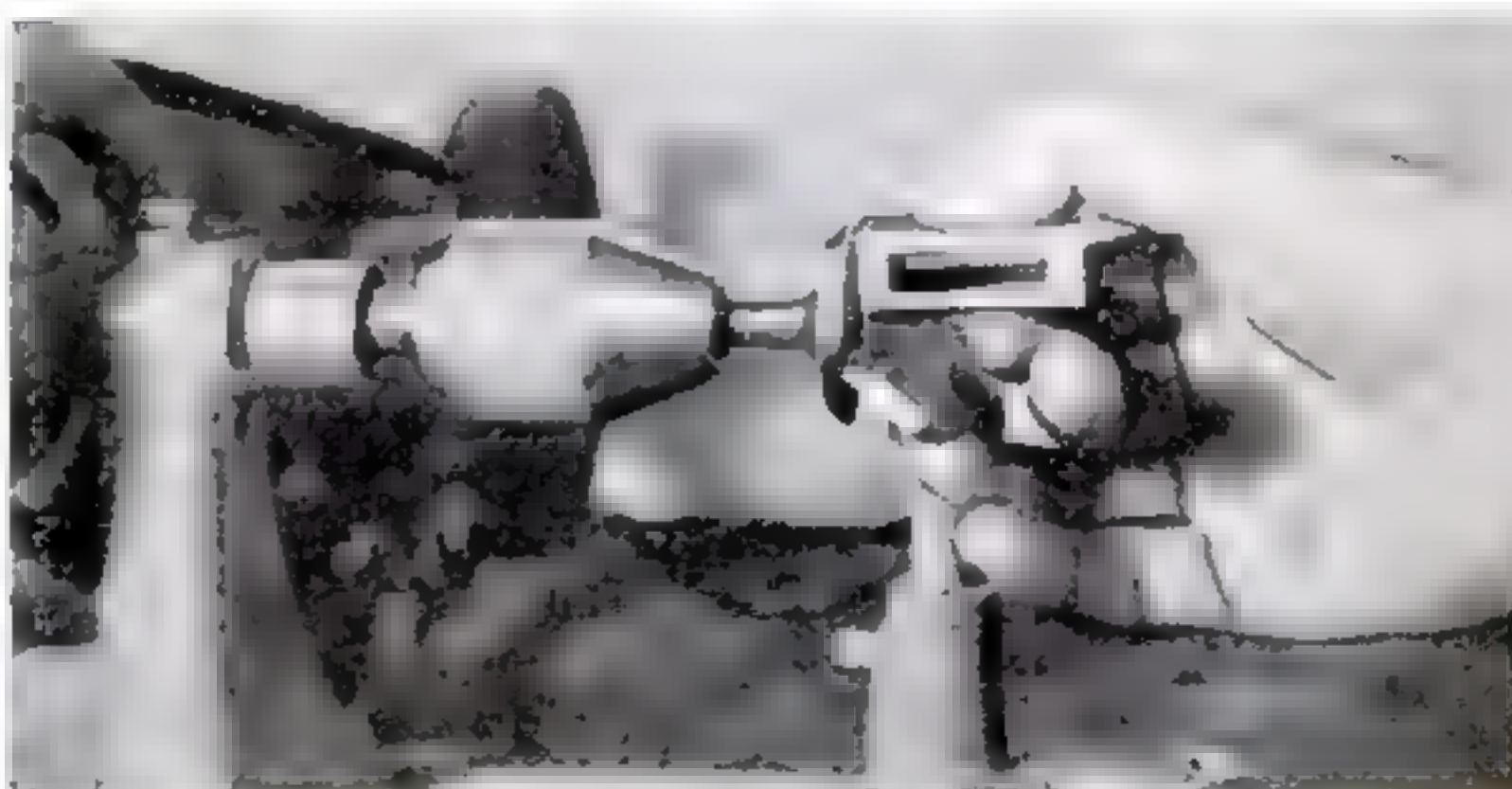


Owners of small circular saws of this type will find that they can store the ripping fence beneath the guide bars

Small Abrasive Disk Made from Old Auto Valve

A SMALL abrasive disk for finishing model parts can be made by cutting off a discarded auto-engine valve about 1" from the head. Some valves have a flat head, but one with a convex head can be used by grinding the top flat. A disk of sandpaper or emery paper is cemented on.

An old valve will also serve as a small faceplate for turning metal disks or rings that cannot be chucked in the usual manner. A cement for attaching the work may be prepared from 1 lb. each of pitch, rosin, and dry whiting, and 1 oz. of yellow wax. Melt all together except the whiting, then stir in the latter.—W. C. W.

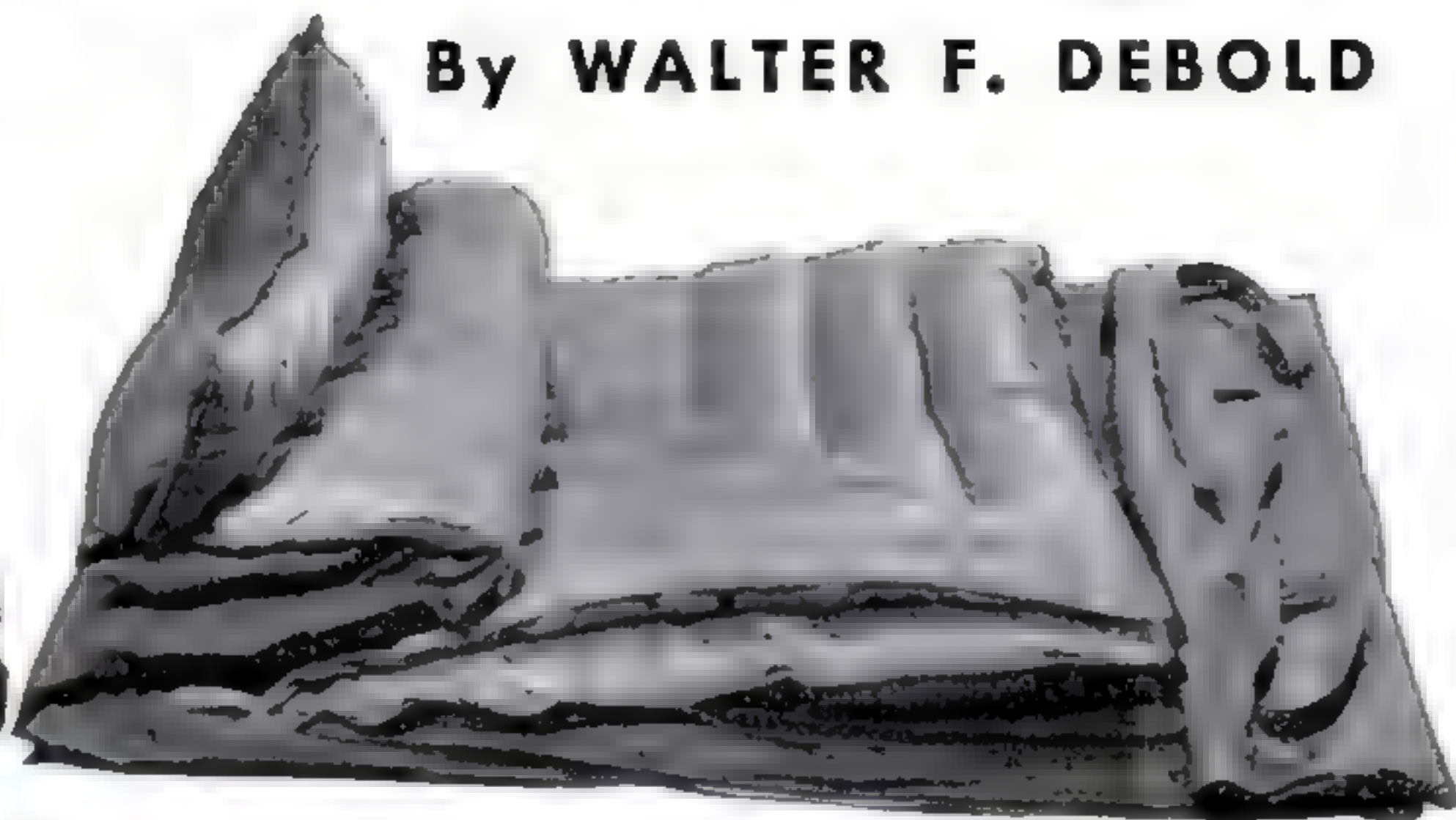


Featherweight

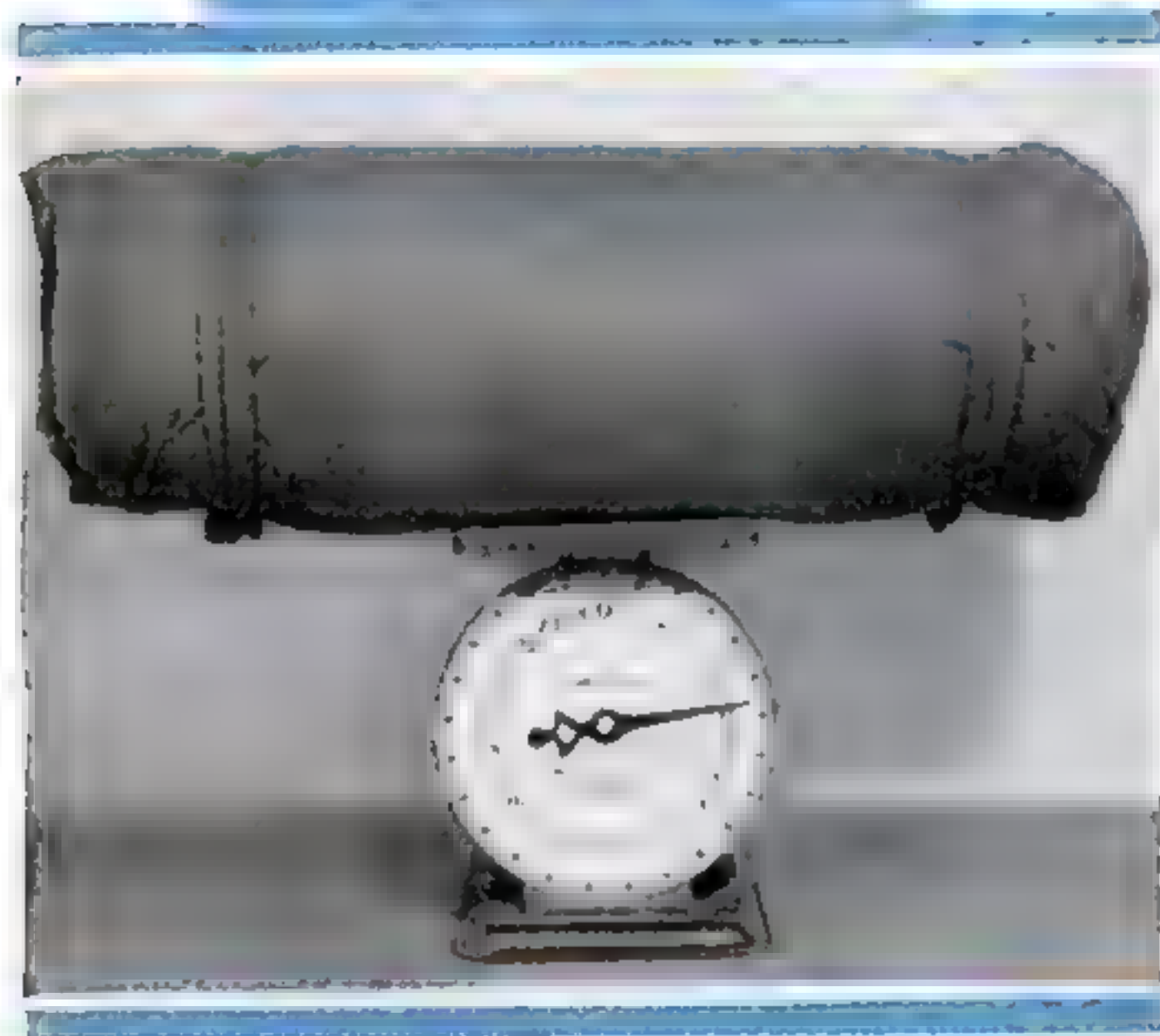
By WALTER F. DEBOLD



When folded and rolled up, the sleeping bag is 18" long and has a diameter of approximately 6"



A comforter is folded in half and sewn along the bottom and halfway up the side. It is covered with a balloon-cloth bag



Because the bag weighs less than 5½ pounds, it can easily be carried in addition to a knapsack

**HERE IS A ROLL FOR HIKERS AND
CAMPERS THAT PROVIDES MAXIMUM
WARMTH WITH MINIMUM WEIGHT**

MINIMUM weight, compactness, and warmth are of great importance in a sleeping bag. The one illustrated has kept me warm and comfortable in the high Sierras when still water has had a half-inch covering of ice.

The materials: A gray goose down comforter 72" by 84" (sateen covered); 6 yd. 34" wide waterproofed balloon cloth; a slide fastener 36" long, and a spool of No. 40 linen thread.

Fold the comforter in half, making a bag 36" by 84", and baste along the bottom and 48" up the side. The remainder will be closed with the slide fastener. Then sew the bag on the sewing machine.

Fold the balloon cloth so that it will cover the comforter. This will leave approximately 48" extra on the top edge, which is used for a tent flap and for making two straps. It is then sewn on the sewing machine approximately ¼" in along one side, the entire length along the bottom, and on the other side so that the same distance is left open as on the comforter. The fastener is now sewn on the remaining length after first being basted in place. Note that the fastener is sewed on facing the inside, for when the sleeping bag is completed it is turned inside out.

The two bags are now laid together. The balloon cloth bag is inside out, and the comforter bag is placed on top of it. The two are hand sewn together on all edges because the average sewing machine will not sew such heavy material, although, if preferred, the bag may be taken to a shoemaker. The

Sleeping Bag



The flap of the sleeping bag may be raised as a windbreak or it may be pulled out completely and used as a tent. At right, sewing the bags

balloon cloth bag may now be turned inside out, placing the comforter on the inside. The top edges of the comforter are next sewn to the outside of the balloon cloth bag. The comforter is also tacked to the balloon cloth bag on the opposite side of the fastener to prevent the comforter from shifting.

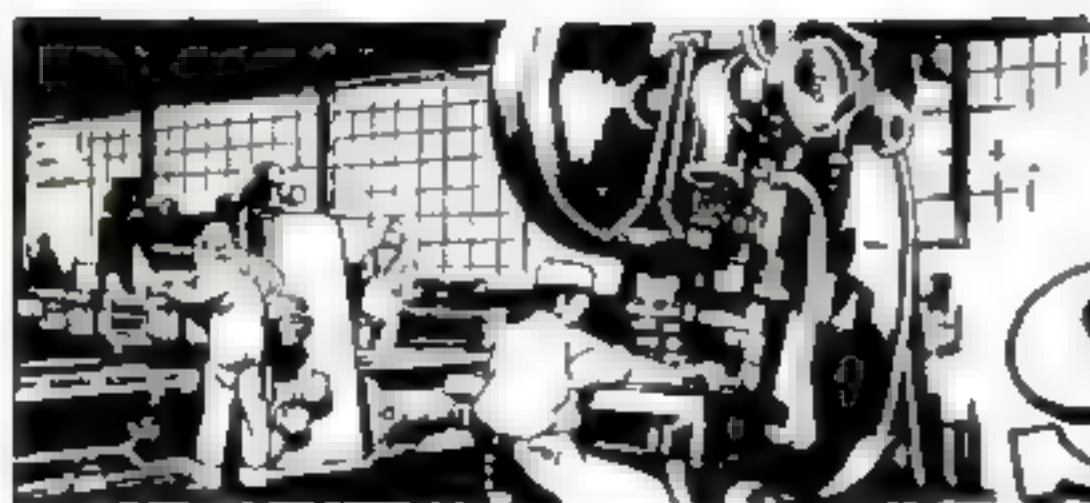
The last step is to cut two strips of material about 2" by 34" from the flap. The 2" width is folded in half and sewn lengthwise. The straps are sewn on the end of the flap with two loops.



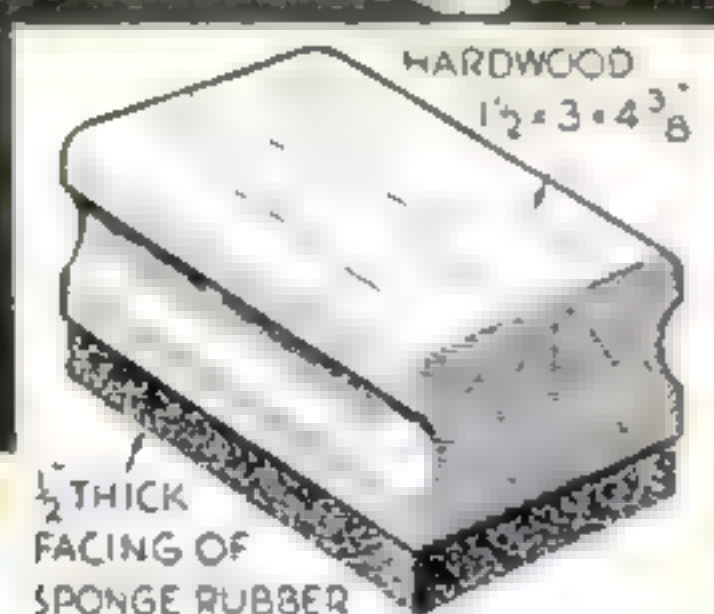
Electric Wires Rubbed on Concrete to Strip Insulating Material

INSULATION can be stripped quickly from the ends of an electric wire by rubbing it vigorously against a concrete floor, sidewalk, or wall. Several quick strokes will strip the insulating material off one side, exposing the copper. A twist of the fingers will then remove the remaining insulation. I find this method so much better than using a jack-knife that I keep a small slab of concrete on my workbench for the purpose.—STEPHEN SMITH.





new SHOP IDEAS



By **RALPH G. WARING**

MANY amateur craftsmen and, indeed, quite a few refinishing-shop operators do not get full value for their money in the use of sandpaper. Wrong grit sizes are chosen, papers are improperly torn and not used both ways of the sheet, and the used portions are not cleaned for further sanding.

For most sanding, some form of backing other than the fingers or hand must be provided. Felt, cork, and rubber blocks are all useful. However, the homemade hand block illustrated has all the requisite good points.

FOR LESS MONEY

It fits the average hand, has a thumb groove, and enables a quarter sheet to be used readily, then changed at right angles to get all possible use from the abrasive—something that patent blocks with spring clip devices do not permit. Often from twenty to thirty percent of the surface of the abrasive is wasted by the use of poorly designed sanding blocks. Best of all, the face of this block is really flat, being cut from a sponge-rubber kneeling pad and glued on with ordinary water glass (solution of sodium silicate). Clamp the block and rubber firmly together, let them set overnight, and then apply a coat or two of thin shellac to the wooden part.

Other pieces of rubber, felt, shaped or molded wooden blocks, and a bit of broom handle, all have a useful place in any group of sand blocks. In using them, take care to sand in straight lines, with the grain.

An ordinary backsaw provides a speedy way to tear the paper accurately. Stack the sheets of standard 9" by 11" paper compactly; fold the top sheet only in straight-lined quarters; and hold the backsaw so that the left hand and thumb press the teeth against the paper on the folded crease line. Grasp several sheets with the right thumb and fingers and with a fast motion toward the body, tear the sheets in two. Change the saw to the opposite fold line and tear the paper into quarters. This is the best size for sanding most wood sur-



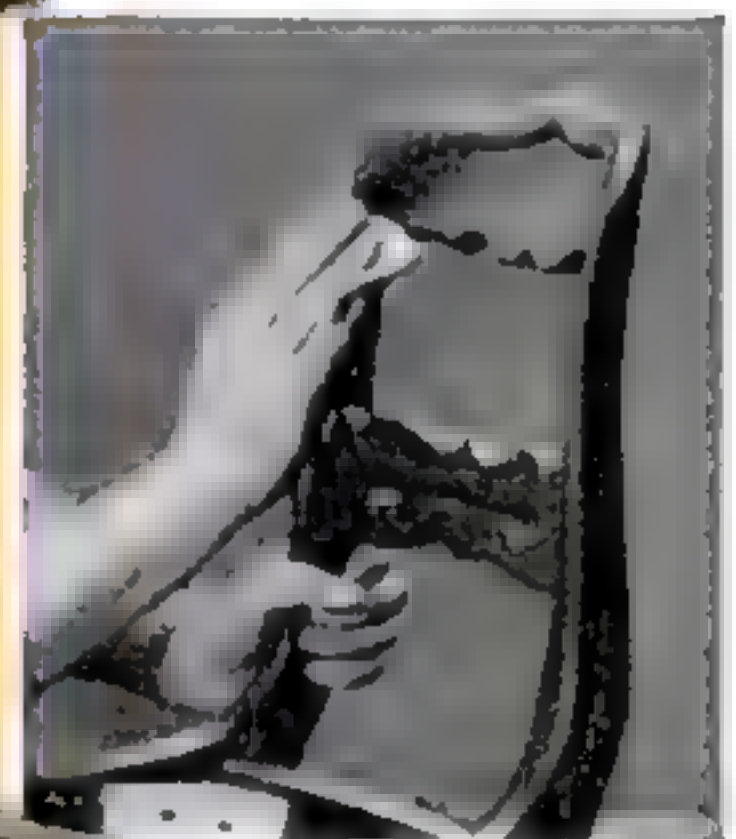
On moldings and curved surfaces, the paper is backed up with a piece of $\frac{1}{2}$ " thick sponge rubber. At right, how the paper is held for water sanding

faces. For sanding finishes, however, tear into eighth-size sheets.

The old-style flint sandpaper has little modern application except for sanding outside paint, which soon clogs any paper. Cabinet sanding and, indeed, most homecraft sanding is best done with garnet papers. Amateurs will also find the modern waterproofed abrasive papers, either garnet or aluminum-oxide, to be fast and

economical. They should be torn and soaked in water previous to use to regain the flexibility lost in storage. In many cases these versatile waterproof papers will replace the older, slower, and messy felt pad, pumice stone, and water or oil for rubbing purposes. When used with a suitable sponge-rubber pad and plenty of water and soap, 400A or 600A paper will produce a polish on varnished or enameled surfaces of greater beauty than otherwise possible. On fine furniture, a final clean-up with used 600A paper and rubbing oil (three parts golden paraffin oil plus one part gasoline) gives an ideal finish.

Below, proper way to hold single-thick or split 6/0 paper for sanding undercoats



SANDPAPER

[PAINTING]

To prepare woodwork for finishing, use dry-sanding garnet papers with the standard "close coating" as follows: $\frac{1}{2}$ or No. 60 grit; $1/0$ or No. 80 grit; $2/0$ or No. 100 grit; $4/0$ or No. 150 grit; and $6/0$ or No. 220 grit.

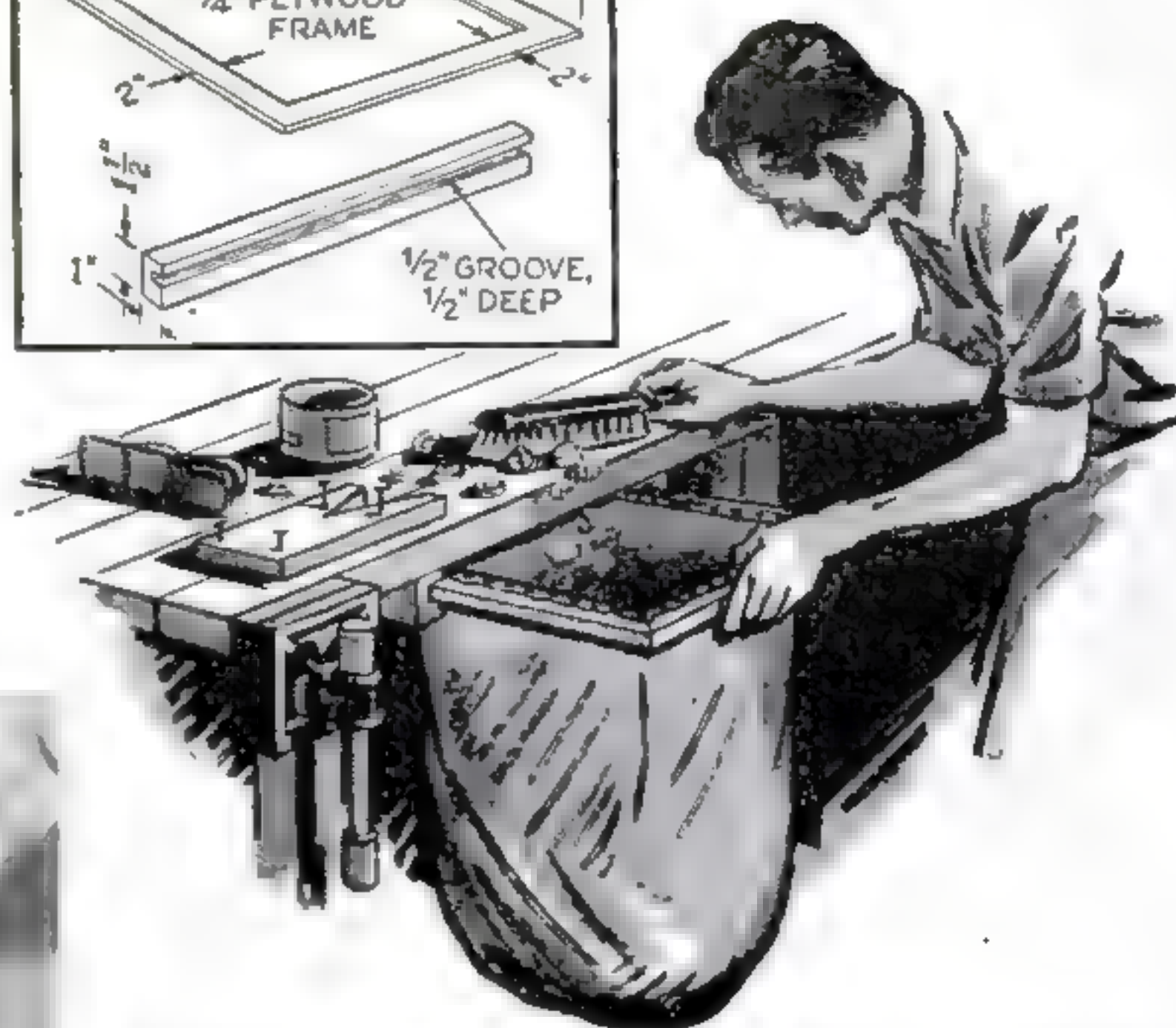
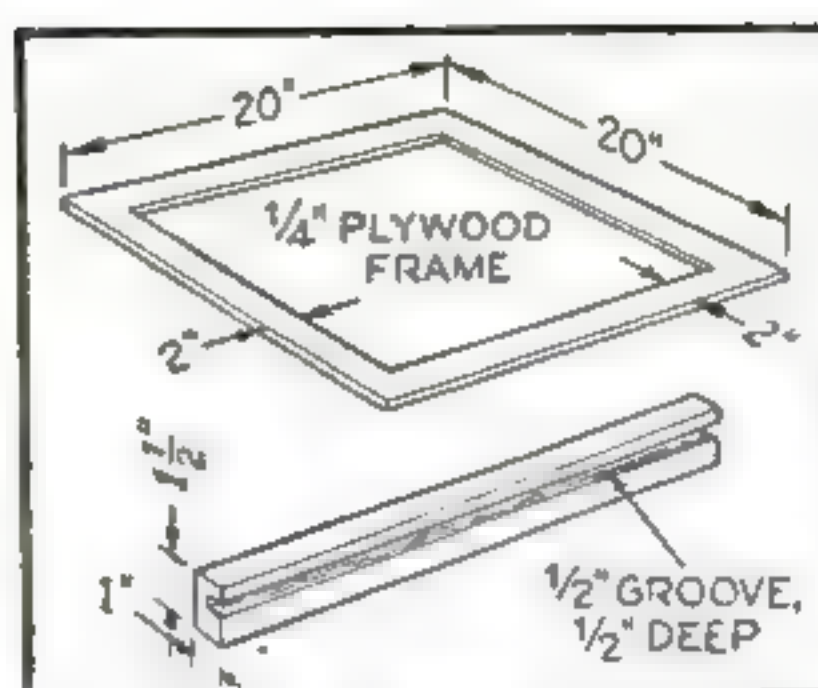
For wet sanding varnish, enamel, or auto work, use single-thick, waterproofed aluminum-oxide finishing papers with standard "open coating" as follows: Between coats—240A, 280A, and 320A. ("A" designates the weight of the paper backing used, in this case light.) Finish coats—400A, 500A, and 600A.

While gasoline is often used as a sanding medium, especially on auto work, water and a white neutral soap or, best of all, a linseed-oil-foots soap of the paste type, insures fast, clean cutting without clogging or scratching. Garnet and aluminum-oxide finishing papers of the standard open-coat type are generally made with the "A" backing. To increase its flexibility further when sanding dry, it is desirable to dampen the paper backing slightly with a sponge. Repeat this as often as the paper gets dry. To clean any of these papers, brush with a dry, flat, ten-cent hand brush. This is better than the ordinary method of striking the paper against something hard.

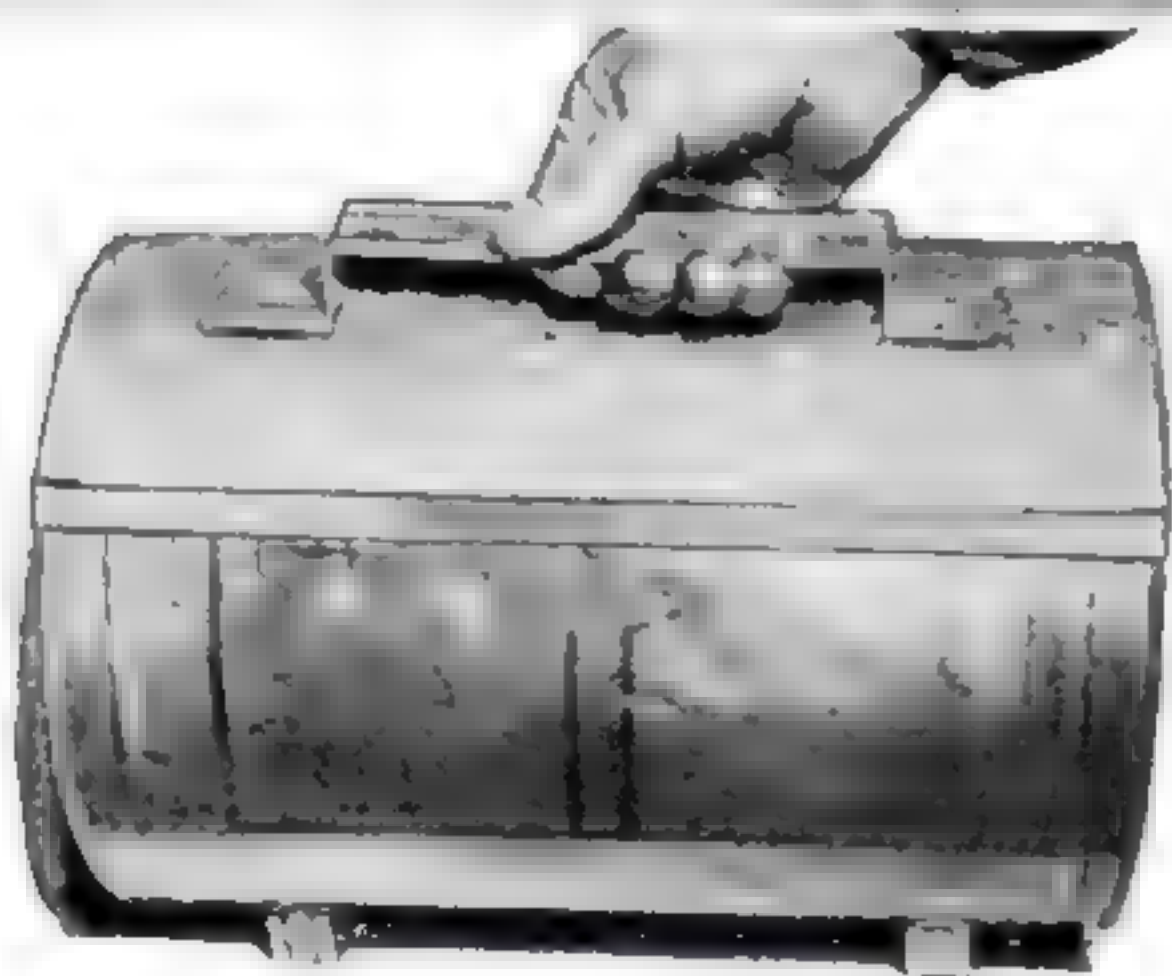
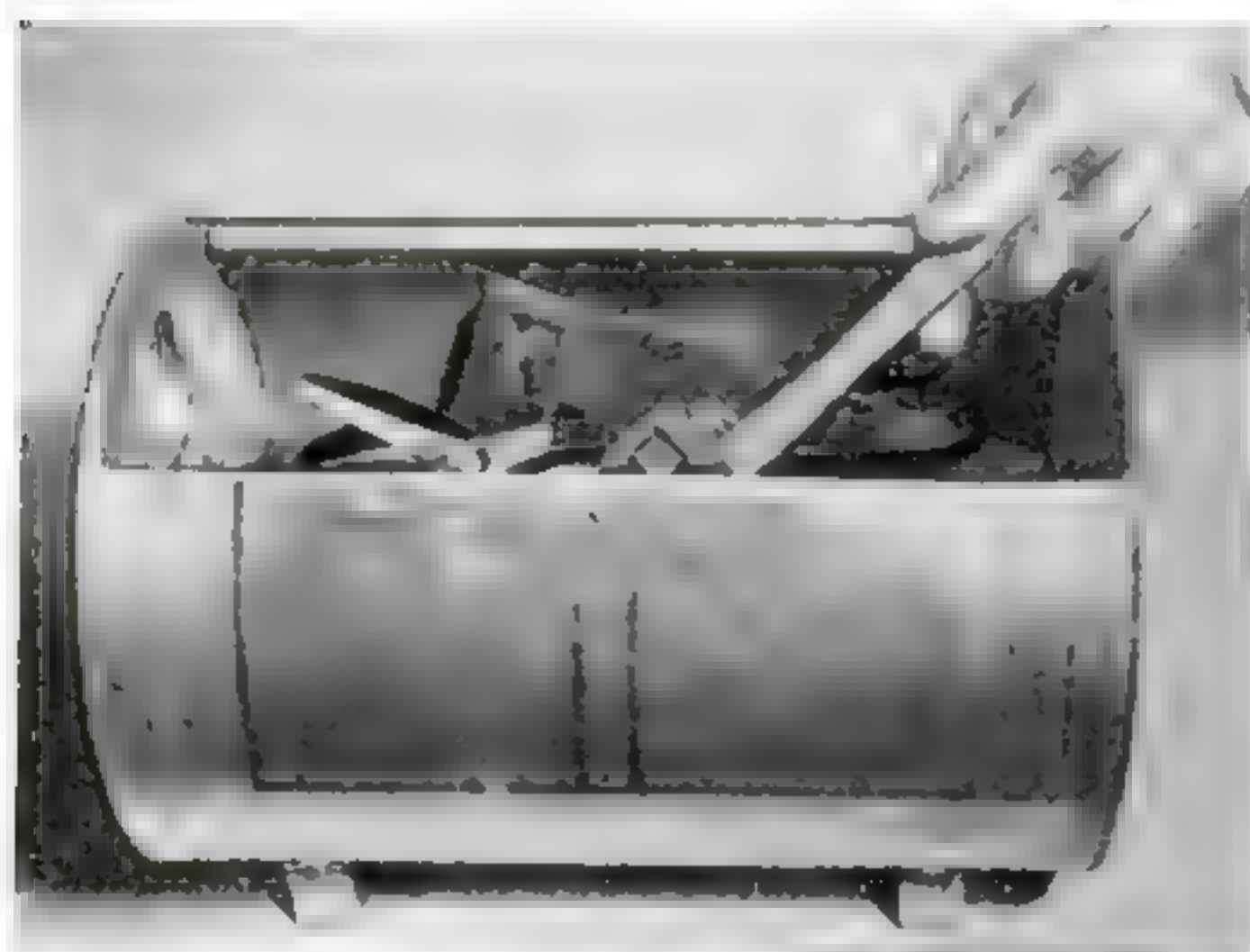
POPULAR SCIENCE MONTHLY SHOP DATA FILE

Dust Catcher Slides Under Workbench

A DRAWERLIKE container to catch the sawdust, shavings, and small scraps brushed off a workbench may be made as illustrated at the right. A frame cut from $\frac{1}{4}$ " plywood is arranged to slide in two grooved strips screwed under the bench top, and a sugar sack or other cloth bag is tacked to the frame. When the container requires emptying, the slide merely is pulled all the way out of the grooves.—GEORGE M. REYNOLDS.

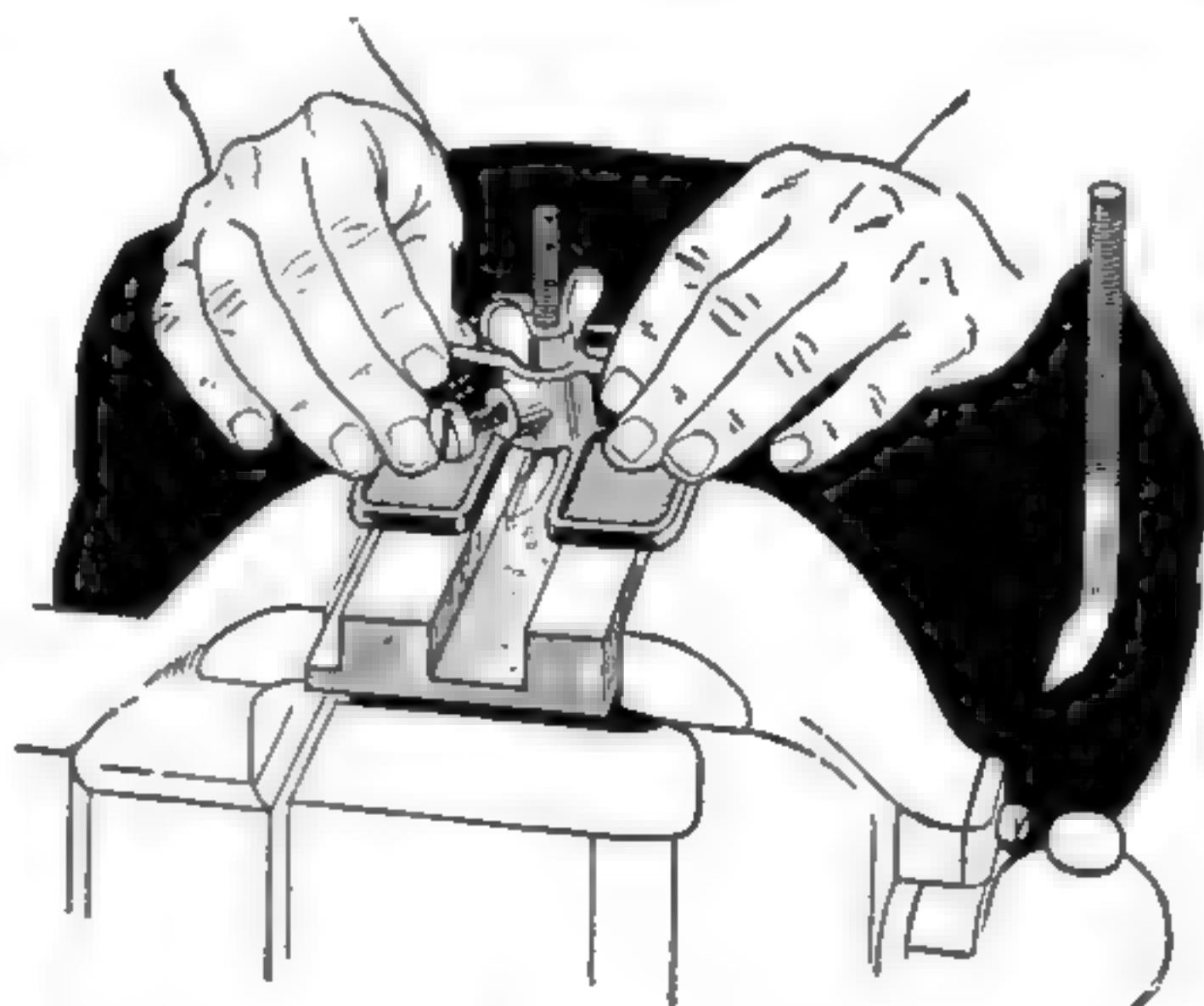


When the bench top is to be dusted off, the sack is pulled out to catch all the sawdust and shavings



Bronze Casting Slotted with Routing Plane

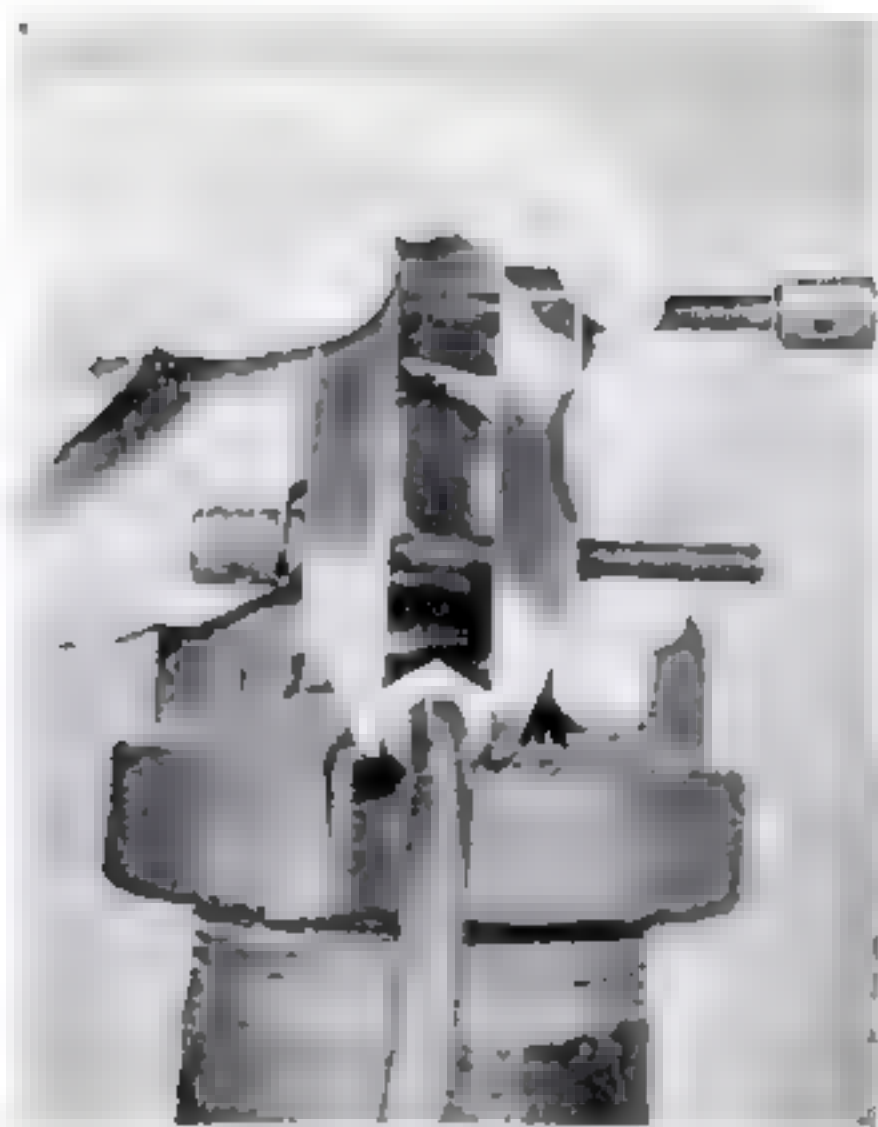
A SLOT in a bronze casting had to be surfaced parallel with the face. In the absence of machine tools, this was done by using an ordinary woodworker's routing plane. The tool bit was made from a short length of drill rod, which was heated and bent to the shape shown. The shank was threaded $\frac{1}{4}$ "-20. The cutting edge was filed to a rather blunt angle, and the sides were made flat to allow working into corners. The tool was then heated cherry red and quenched, making it glass-hard. After being ground, it was ready for use. Fine adjustment was obtained by the use of the wing nut.—S. J. G.



The face of the work was first made level, then the router finished the slot to an accurate surface

Large Round Can Changed into a Handy Tool Box

FROM a cylindrical 5-gal. can it is possible for anyone who has had some experience in metal work to make a small tool box. Cut a 7" wide opening in the side, as shown, and turn the edges for smoothness. A lid of 26-gauge galvanized iron is formed to fit over the opening, and the ends are bent over and under the projecting rim at the top and bottom of the can. Near the front edge, the lid is bent down to make a stop to prevent sliding it too far in either direction. The handle and two legs are cut from galvanized iron, the edges are double folded, and the pieces are bent to shape and soldered.—B. N.



Parallel Clamp Serves as Wrench

LEONARDO DA VINCI, the Italian painter, designed a wrench that closely resembled a modern machinist's parallel clamp. His idea is still good because in certain emergencies a parallel clamp will act as a wrench. It is even more accurately adjustable to the exact nut size than a wrench, and the jaws will not spread. Care must be taken, however, to hold the clamp so that its screws will not be bent.—D. S. GARDE.

When a clamp is used as a wrench in an emergency, hold it in this way so as not to bend the screws



Hot Ammonium Citrate Quickly Removes Rust

A SOLUTION of ammonium citrate of practically any strength is an excellent rust remover. Used hot, it removes rust in a minute or two; if cold, it will do it overnight. When it is not convenient to lay the article in the solution, as for example the long steel sword scabbard illustrated, a layer of cotton cloth may be wrapped around it and the hot solution poured over the cloth.—R. W.

Stopping Small Leak in a Dam

TO HOLD back the water when repairing a small leak in a concrete dam, I applied a mixture of one part plaster of Paris to five of prepared cement. When it set hard, I finished the patch with regular cement.—D. H.

TEMPERING TEMPERATURES

[METAL WORKING]

Temp. range in deg. F.	Color of oxide film	Type of tools
437 to 455	Light straw to straw	Scrapers for brass, steel-engraving tools, light turning tools, hammer faces, planer tools for steel, planer tools for iron, wood-engraving tools, drills, milling cutters
456 to 482	Dark straw to yellow-brown	Wire-drawing plates, boring cutters, screw-cutting dies, taps, rock drills, mill chisels and picks, punches and dies, reamers, shear blades, half-round bits, planer knives and molding cutters (to be ground), gouges, plane irons
483 to 527	Yellow-brown to dark purple	Twist drills, flat drills, wood-boring cutters, drifts, cup tools, edging cutters
528 to 572	Dark purple to full blue	Wood bits and augers, cold chisels for steel, axes and adzes, gimlets, cold chisels for cast iron, needles, wood chisels, hack saws, cold chisels for wrought iron, planer knives and molding cutters (to be filed), circular saws for metal, screw drivers, springs, saws for wood.

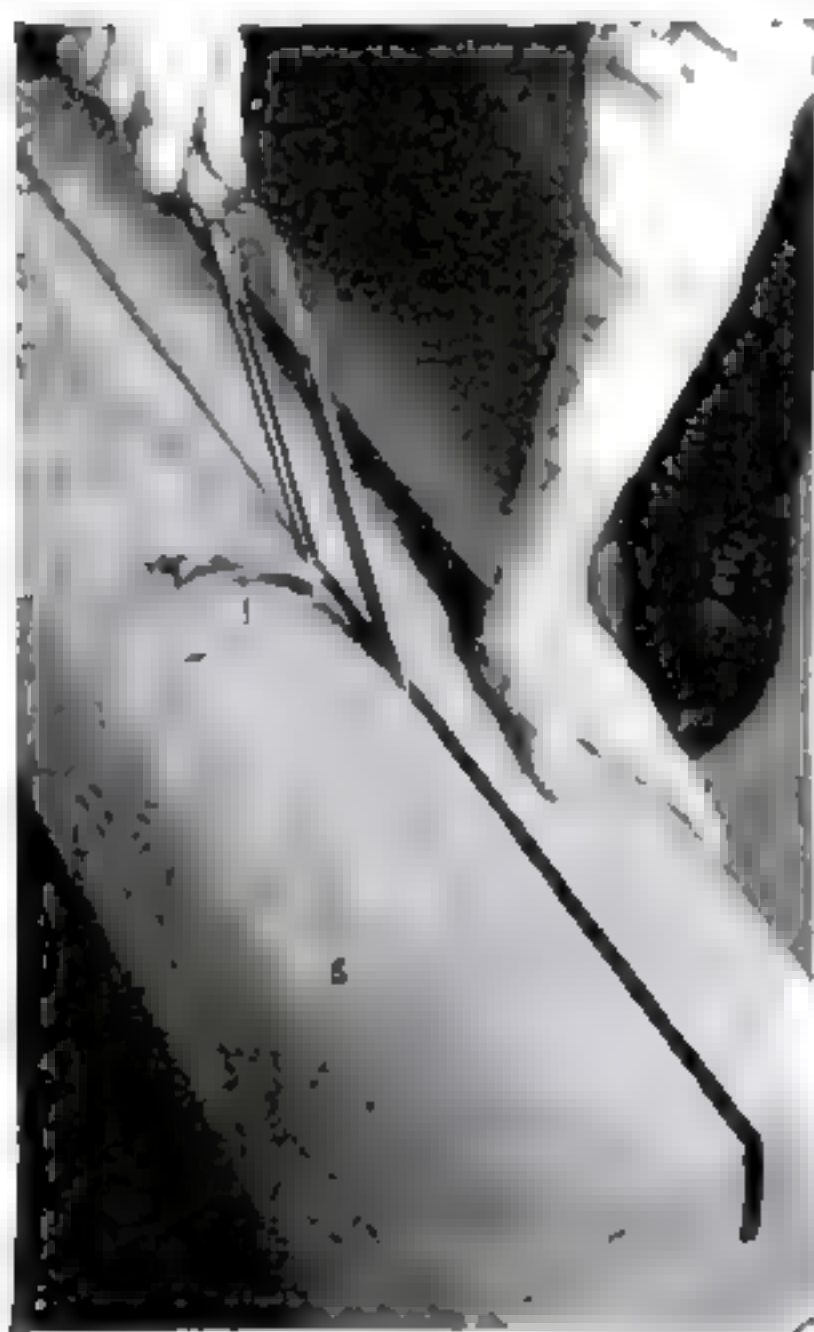
Note: The tools are arranged approximately in their order on the color scale.

POPULAR SCIENCE MONTHLY SHOP DATA FILE

Drills Stored in Corrugated Board

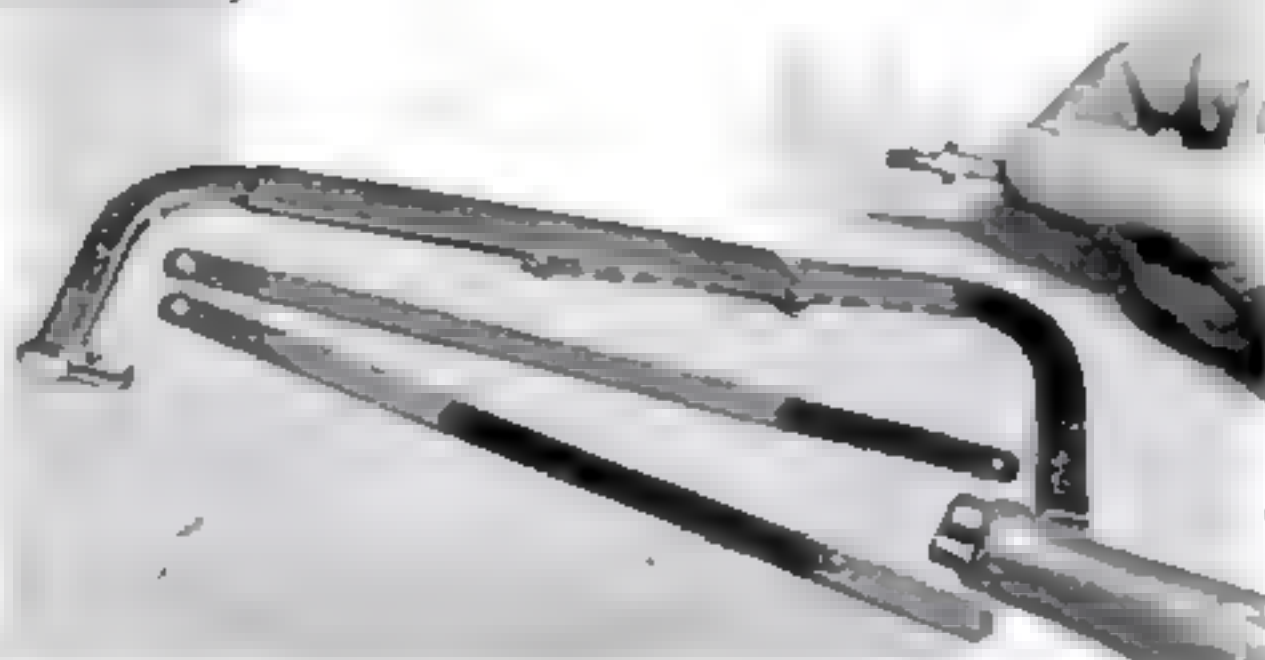
ORDINARY drill boxes or indexes have only one place for each size drill, so it is always a problem to know what to do with duplicate drills that accumulate in the course of time. I make holders for them from pieces cut from corrugated paper boxes into suitable lengths and of a width equal to about half the length of the drills they are to contain. The bottom of each piece may be taped over, and several pieces may be stuck together to make a drill stand or to line the side of a tool drawer. The corrugations may be crimped for very small drills.—R. B. ROCHESTER.

Hot Water Tank Cut Lengthwise with Double-Bladed Hack Saw



Above, cutting a water tank in half. At right, the hack saw is altered to take two blades by drilling shanks and inserting extension pins

IF AN old hot water tank has to be cut lengthwise to make a trough or outdoor flower box, a neat job may be made by using a hack saw altered so as to hold a blade on each side. This is done by drilling the shanks and inserting pins that extend far enough to hold the blades. Mark off the cutting line on the tank and start sawing at one corner. The narrow metal strip sawed out must be kept bent to one side, out of the way of the hack-saw frame.—BENJAMIN NIELSEN.



Pieces of corrugated board are cut into suitable lengths and taped together as drill stands

Model Portholes Made from Wire

PORTHOLES for a small model of an auxiliary sloop were made by winding very fine copper wire around a needle many times, cutting off the turns, flattening them with a hammer, and pinching them together with tweezers in order to form rings. These were cemented carefully in place one by one to form the tiny porthole rims.—EDWARD R. WEBER.

Bent Wood Screw Serves as a Countersink

WHEN a number of flathead wood screws have to be driven and no countersink bit is at hand, a substitute can be made from a fairly long flathead screw which has a head of the same diameter as the screws to be used. Bend the shank of the screw to nearly a right angle, and fit a 5" or 6" length of brass or steel tubing over the point. Using this tubing as a handle, rotate the screw head in each hole that has been drilled for the screws. The sharp edge will countersink the hole to the right diameter.



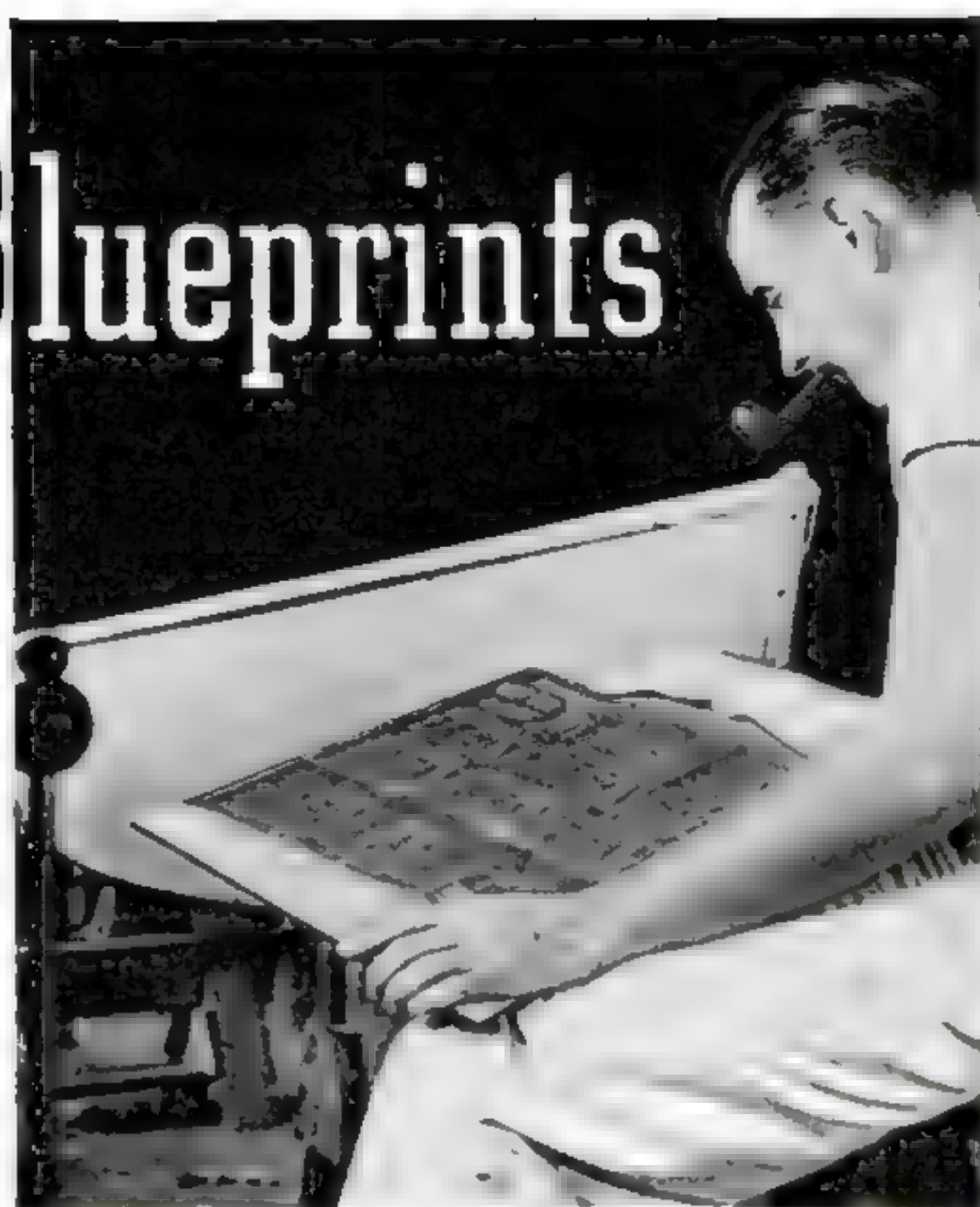
The bent screw is fitted into tubing and rotated in each hole until the head has been sunk in halfway

HINTS ON Reading Boat Blueprints

By WILLARD
and BRUCE CRANDALL

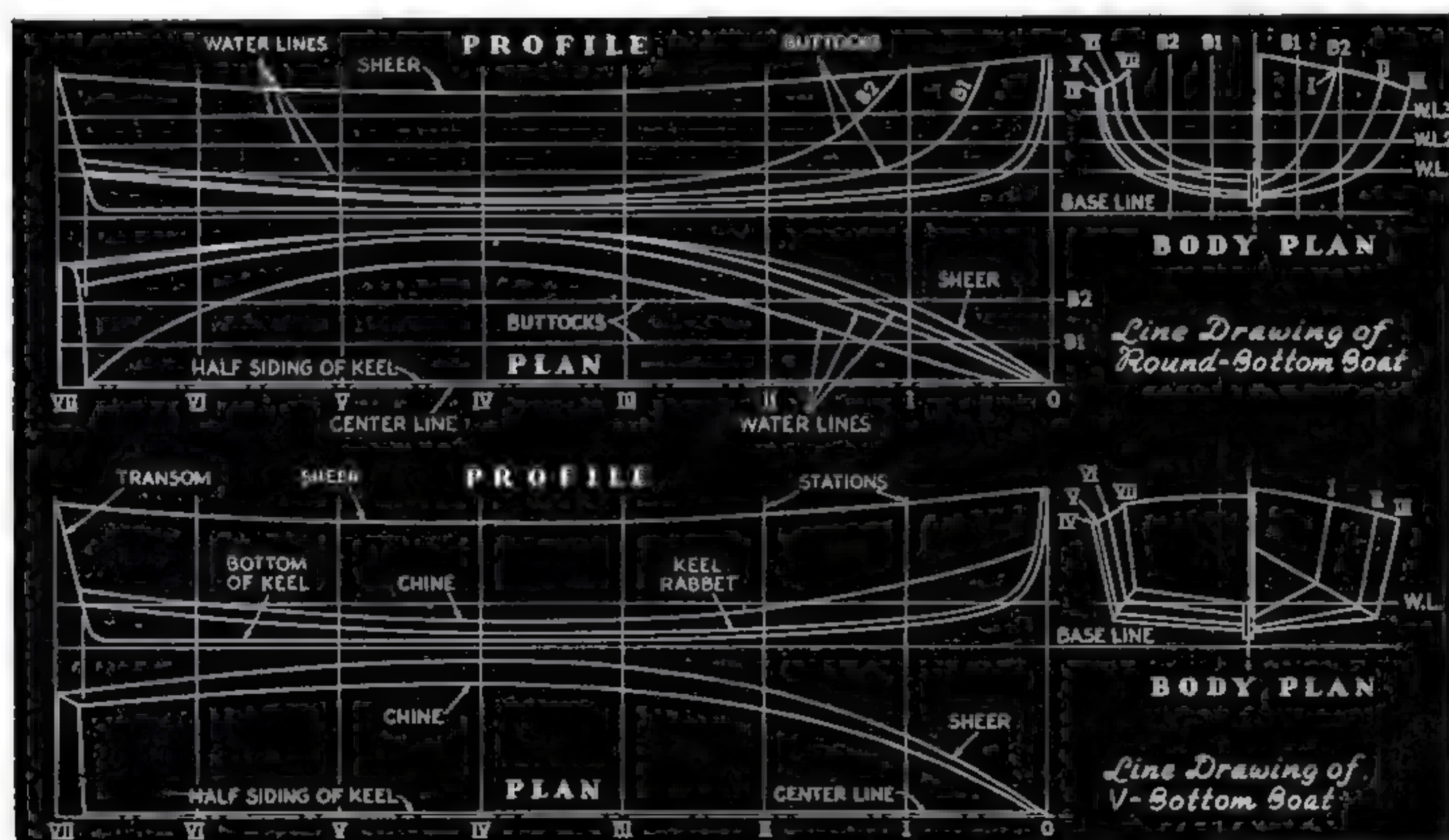
BEFORE starting to build any boat, you must understand the meaning of the drawings or blueprints. These always give the design of the boat as seen from three different viewpoints. The profile drawing, or elevation, shows the boat viewed from the side; the plan is a view from the top or bottom, and the body plan shows how the boat looks when viewed directly from either end. The body plan contains the station lines, which are cross sections at various points.

The builder should never attempt to scale the line drawings because the table of offsets gives the measurements at each station, taken horizontally from the center line and vertically from the base line. The spacing of the stations and other measurements that cannot be given in the table of offsets are shown on the plan and profile drawings. All measurements are given to the outside of the planking, and it is only after the complete set of lines has been reproduced full size that accurate measurements of the frames to the inside of the planking can be determined.



With most V-bottom boats, the station lines shown on the plan and profile represent the location of the frames of the boat, but in many cases, and especially with round-bottom boats, they represent the location of temporary molds, the actual frames or ribs being spaced between them.

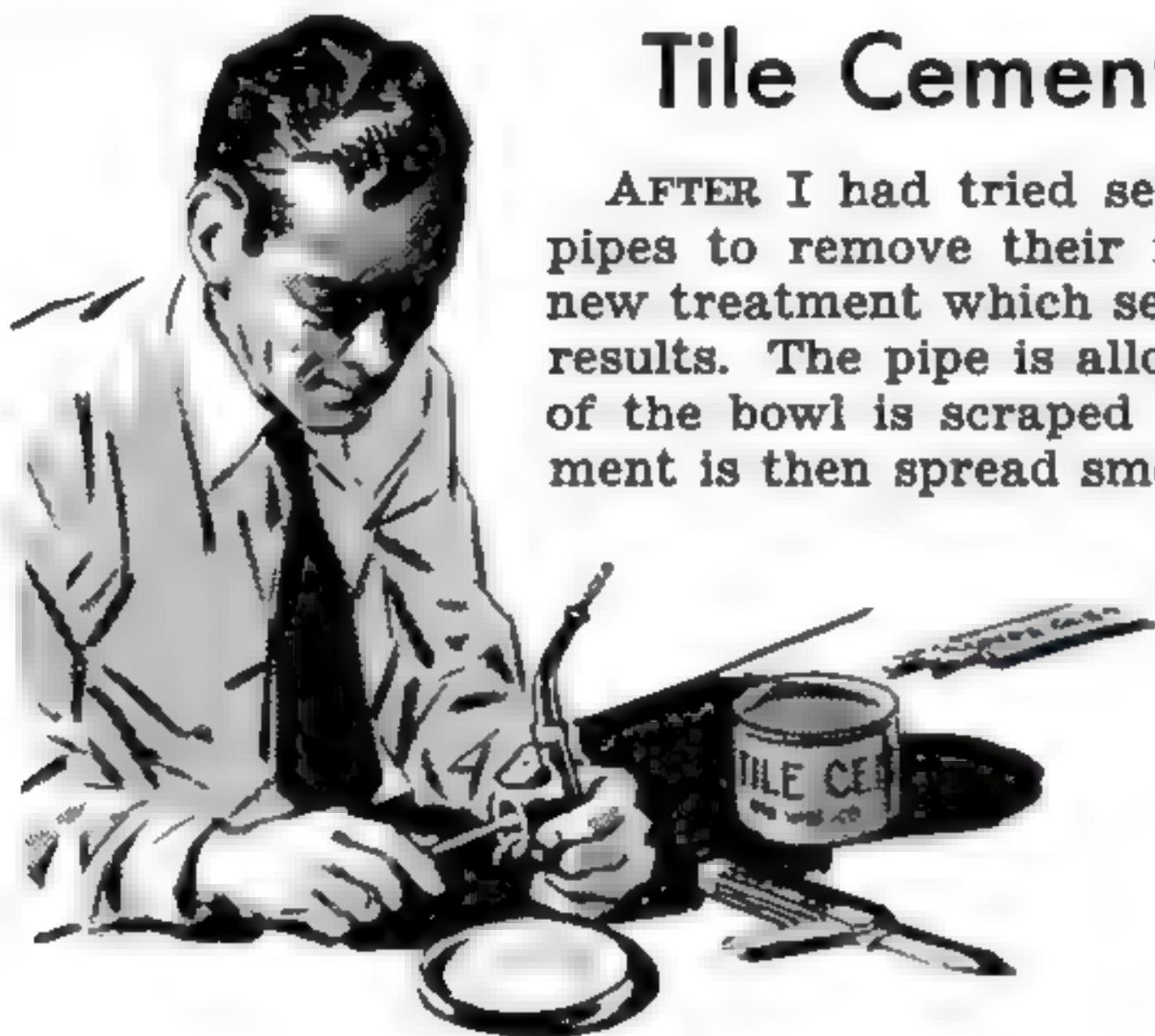
If the boat is a simple V-bottom design with straight sections, the entire shape of the boat will be shown by the sheer, chine, rabbet, and keel lines in the profile view and the sheer and chine lines in the plan view. However, if the boat is a more com-



plicated V-bottom or a round-bottom design, certain other lines will be shown to represent various imaginary planes cut through the hull. Thus, in a V-bottom boat that has curved side frames, there may be several water lines representing various horizontal planes or cuts through the hull. In the drawings of a round-bottom boat the shape is shown by numerous water lines, and by buttock lines which represent

vertical planes parallel to the center plane.

POPULAR SCIENCE boat blueprints also include drawings that show the accurate measurements of the frames (with planking thickness deducted), stem, the projected transom, and other parts such as the keel form and knees. These make it unnecessary for each individual builder to reproduce the entire set of line drawings full size. There are also drawings of the entire boat.



Tile Cement Renews Old Brier Pipe

AFTER I had tried several standard methods of cleaning old brier pipes to remove their rather strong taste and odor, I discovered a new treatment which seems to give more satisfactory and permanent results. The pipe is allowed to become thoroughly dry and the inside of the bowl is scraped clean. A thin layer of plastic tile-setting cement is then spread smoothly over the inside of the bowl and allowed

to dry. It is advisable to run a pipe cleaner through the stem first to protect the hole.

Practically all large hardware stores carry tile cement. Some types may contain ingredients which would prove undesirable for this purpose, but I used the common variety of tile-setting cement, which is a white, pasty, inert substance sold in small cans.—ROBERT W. BRIGGS.

Pulley Aids Laundry Weighing

HOUSEWIVES who send their laundry out and wish to weigh it beforehand can do so without undue effort by using a small spring scale tied to a cord and running over a pulley as illustrated at the right. A strong cup hook can be screwed above a convenient doorway for supporting the pulley. The pulley, scale, and cord may be kept in a nearby closet.—LOUIS HOCHMAN.

Special Wooden Wrench Loosens Tight Faceplate on Lathe



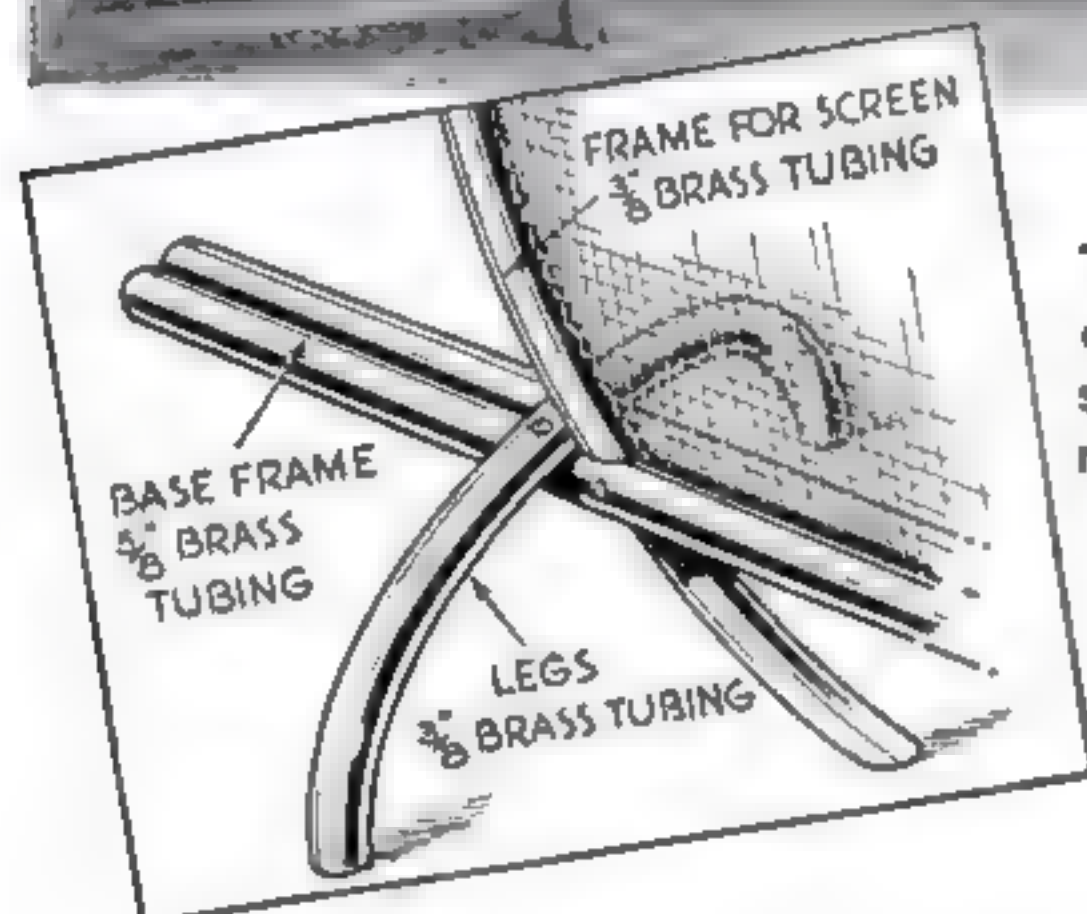
A TIGHT faceplate on a woodworking lathe is sometimes difficult to remove, especially as most lathes come equipped with only one wrench for this purpose. A simple expedient is to make a second wrench from $\frac{3}{4}$ " plywood as shown, with $\frac{1}{4}$ " carriage bolts set into it to match the holes in the faceplate. Washers and nuts are added. This wrench will turn the faceplate while the regular wrench is used to hold the spindle of the lathe.



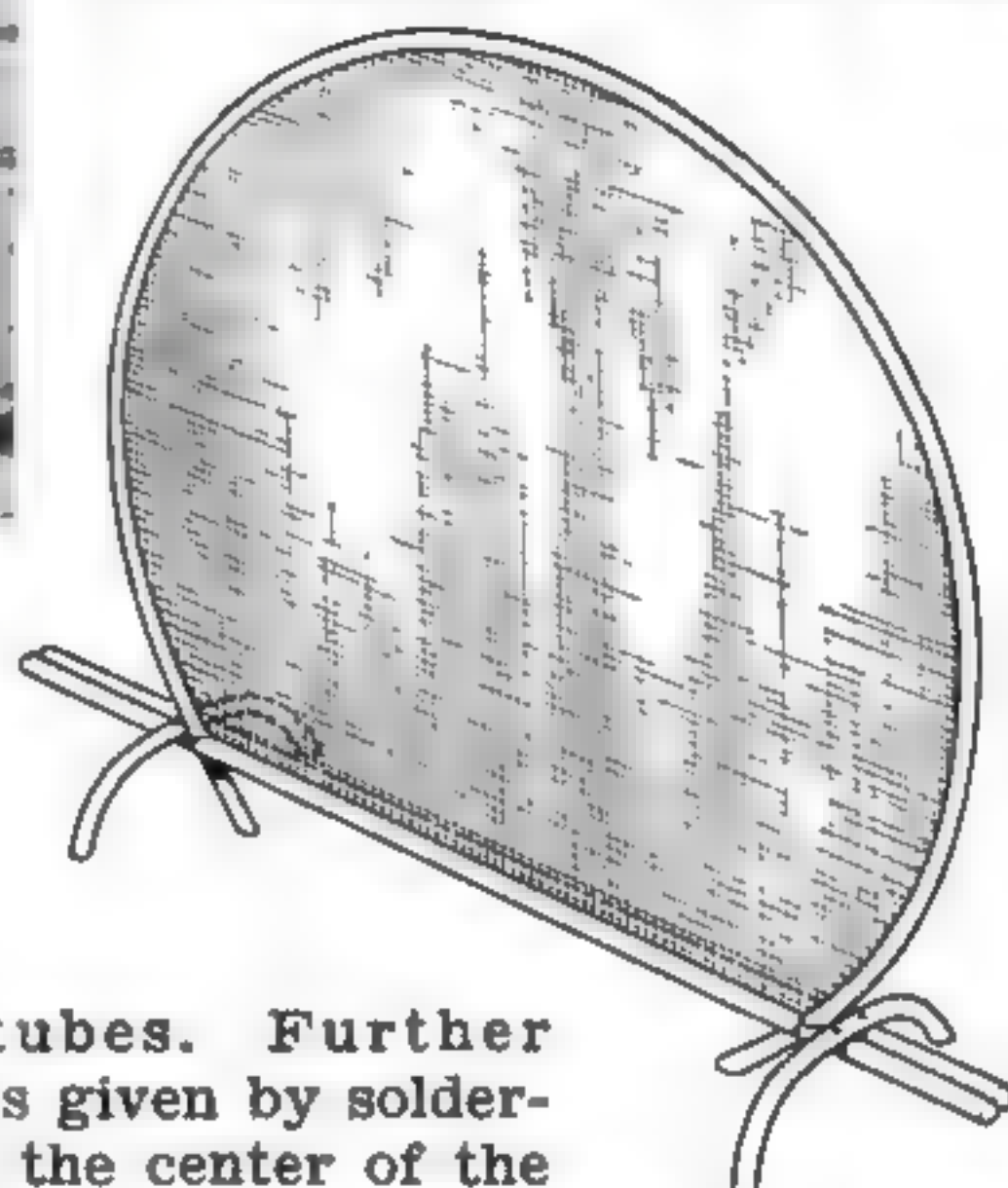
Hoisting the laundry bag up by means of a pulley provides an easier way of reading the scale than trying to hold it aloft

CIRCULAR Fire Screen

HAS FRAME OF BRASS TUBING



The completed screen and, at left, sketch showing how the lower members are fastened



of the tubes. Further strength is given by soldering along the center of the tubes on the underside after assembly. When the frame has been inserted, holes are drilled through the base tubes, and the frame is then tapped to take small bolts, which are inserted from both sides.

The screen is stretched taut and soldered on the circular frame, after which it is trimmed. Use plenty of solder and file it down to give a smooth surface. The legs are made of tubing as shown, and attached with bolts and solder.—ROBERT GASH.

AN EXPENSIVE-LOOKING fireplace screen of modern design can be made without difficulty for about five dollars. The size is determined by the fireplace opening, so draw the opening full size on wrapping paper and sketch in the outline of the screen in such a way that it cuts slightly within the upper corners. From this drawing it is possible to determine how much material to purchase.

The outline of the screen is $\frac{3}{8}$ " diameter brass tubing. This should be soft brass so that it can be bent without difficulty. Another piece $\frac{5}{8}$ " in diameter is required for the base. A suitable piece of brass screen, about a dozen small brass bolts and nuts, and solder are also required. The necessary tools are a hack saw, files, screw driver, pincers, hand drill, a tap of same size as the bolts, soldering iron, and tin snips or old shears.

As an aid in bending the frame of the screen, it is well to draw a circle on any wooden surface—the back fence will do—and nail small wooden blocks around the circumference so that the tubing can be gently hammered into shape with a soft wooden stick. The base frame consists of two $\frac{5}{8}$ " brass tubes side by side with circular notches filed in them for securing the circular screen. Note that these notches cross the tubes at an angle. Before assembling the base, however, it is necessary to solder the bottom edge of the screen to one

Starting a Nut on a Bolt in an Awkward Place

THERE are many ways to start a nut on the threads of a bolt located so that it is almost impossible to reach it, but one of the simplest is to fasten the nut on the forefinger with a piece of cellulose tape, as shown at the right. Punch a hole through the tape to correspond to the hole in the nut. The nut may then be handled without fear of dropping it, and after it has been started on the bolt, the finger can be pulled away, leaving only a small piece of the tape on the nut.—ARTHUR C. NELSON.



Chemical Engineering

HOW would you like to transform your home laboratory into a miniature factory for obtaining useful products from minerals, with yourself as its amateur chemical engineer? You can roast ores to obtain important metals, convert plain-looking stones into sparkling white crystals, operate a rotating kiln, and magically separate wanted minerals from unwanted ones by a flotation process.

This may sound as though it would make rather a severe dent in your pocketbook. Nothing could be farther from the truth. Your rotating kilns or reaction kettles will be tin cans, supported horizontally and turned by your own hand. For a roasting furnace, frequently employed by metallurgical engineers, you will use a porcelain crucible or the bowl of a clay bubble pipe. Heating kettles may be squat tin cans, porcelain evaporating dishes, or beak-

ers you can find on your laboratory shelf.

As for your raw materials, they will be the very same ones with which professional engineers have to deal. Perhaps you may live in a good locality for collecting some of the minerals that will be mentioned here. No matter if you don't, for many dealers in chemicals can supply them. For variety, you will find an excellent source of supply in the "mineralogical sets" of assorted specimens for beginners, now on the market. For bulk consumption, the "pound material" for mineral collectors, sold by some firms at a few cents a pound, will prove ideal.

By RAYMOND B. WAILES

Orthoclase (feldspar) adsorbs color of phenolphthalein. Other tube contains cryolite, almost invisible in water

Inexpensive metallurgy kits provide materials for many tests. The experimenter is using a homemade iron mortar



for Home Experimenters

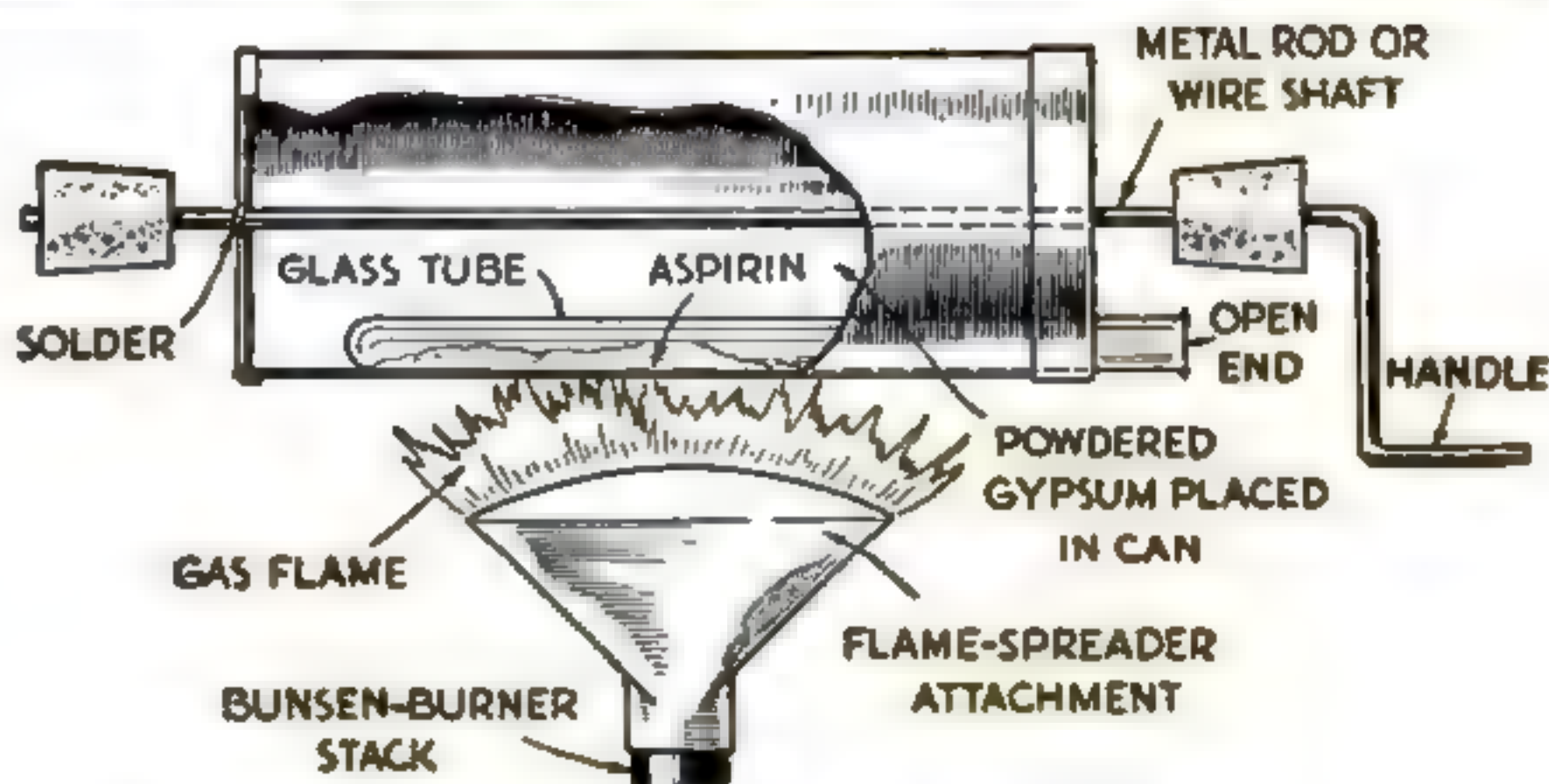
Would you like to prepare a widely used metal from a well-known ore? You can easily extract lead from galena, a natural mineral which has been used in crystal radio receivers. Chemically, galena is a compound of lead and sulphur, called lead sulphide.

Professional metallurgists grind this ore and roast it at low heat, in a chamber resembling a blast furnace. During this process, the oxygen of the air converts part of the galena into lead oxide and lead sulphate. Then the temperature of the roasting chamber is raised. By reaction with the initial products, the unconverted galena is transformed into metallic lead, which is tapped off at the bottom of the furnace.

You can dispense with the preliminary step by mixing powdered galena (lead sulphide) with twice its weight of litharge (lead oxide). Place the mixture in a porcelain crucible or the bowl of a clay bubble pipe, and keep it at bright-red heat for about twenty minutes. The molten lead may then be poured off from the vessel. Hammering the metal will convince you that it is really lead.

In the purity of the material that you have to work with, you have an advantage over the professional chemist or metallurgist. His ore may be quartz rock in which the pure galena appears only as veins or streaks. However, in a clever process that he calls flotation, he has found a way to separate the valuable galena from the worthless quartz. You can try out his scheme for yourself.

Pulverize very finely, and mix thoroughly,



A rotating kiln, like those used in industry, is easily made from a tin can as shown in the drawing above. In the photograph, it is being used in the laboratory to make plaster of Paris from gypsum

equal portions of galena and common sand. Place a spoonful of this mixture in a pint bottle or a mayonnaise jar. Add a drop of pine oil, or cresol, and half fill the vessel with water. Shake vigorously, and then let the contents settle. The oil will rise to the



Crystals of barium chloride being removed from the evaporating dish for bottling. Right, details of attachment for the lamp-bulb heater



surface of the water, carrying a large amount of the galena with it. Meanwhile the sand, which represents the worthless quartz in actual commercial practice, is left behind on the bottom.

An important ore of antimony metal is a mineral called stibnite, which usually is included in small mineralogy sets. It consists of a sulphide of antimony. In the commercial process, which you can easily duplicate, the antimony is extracted by heating stibnite with half its weight of iron filings.

Place this mixture in the bowl of a clay bubble pipe, or in a porcelain crucible. Also add a bit of sodium sulphate, and of powdered coal. These will act as a flux and assist the reaction between the iron and

the stibnite. A bright-red heat is required for this reaction, which takes about forty-five minutes for its completion. The metallic antimony, which will be found at the bottom of the pipe bowl or crucible, is best removed by breaking open the container.

Lime, a material of great chemical and industrial importance, is produced rather simply. Limestone (calcium carbonate) is heated to redness in upright kilns, releasing carbon dioxide into the air and leaving the lime (calcium oxide) behind. To duplicate the process in your home laboratory, heat ordinary limestone or chips of marble (crystallized limestone) to redness for several hours. This may be done in a porcelain crucible, using a Bunsen burner; or,



Heavy-Duty Mortar Made of Pipe Cap

A TWO-INCCH pipe cap will make a serviceable heavy-duty mortar for pulverizing the rocks, minerals, and crude chemicals that you use in your experiments. Its pestle is a six or seven-inch length of half-inch pipe, threaded and fitted at each end with a half-inch pipe cap. If preferred, the cap at the upper end may be a rubber tip of the sort used on crutches or the legs of chairs and stools. This latter arrangement is a little easier on the hands in working with hard materials.

if you want to produce a larger amount of lime, place a few ounces of limestone or marble in a sand crucible and heat it for several hours in a coal fire.

Converting gypsum, a common mineral, into plaster of Paris will afford an enjoyable hour or two of chemical experimenting. Held in the hand, gypsum is just a common-looking, light-colored rock. Chemically it consists of calcium sulphate molecules, to each of which is attached a pair of water molecules. When gypsum is heated, some of this "water of crystallization" is driven off. The calcium sulphate that is left behind (with more or less water remaining, depending upon the dehydrating temperature) is the product known as plaster of Paris. When it is mixed with water, its molecules reunite with some of the water molecules and a hard mass is formed, closely approximating the composition of the original gypsum.

Rotating kilns, kettles, or muffle furnaces are used for making plaster of Paris commercially. One simple way you can prepare a small quantity is to heat powdered gypsum with a very low flame, from below, in an evaporating dish or a squat tin can. To control the temperature, stir the powder during the process with a chemical thermometer. When the material first becomes warm, you will observe "dew" or moisture being driven from the powder and condensing upon the thermometer. Keep the temperature at about 145 degrees C. (293 degrees F.) for half an hour, stirring every five minutes or so. When cold, the powder will set to a hard mass on being mixed with water. If the temperature used in preparing it is too high, the product will be "hard burned" and will take longer to set.

A MODEL rotating kiln, like those used in industry, may also be used to make plaster of Paris from gypsum. Pierce the lid and bottom of a baking-powder can and insert a stiff metal rod or wire, bent into a crank at one end, as illustrated. The rod is passed through the centers of the lid and bottom, and is attached to the metal with solder to keep it from slipping when the can is rotated with a heavy load.



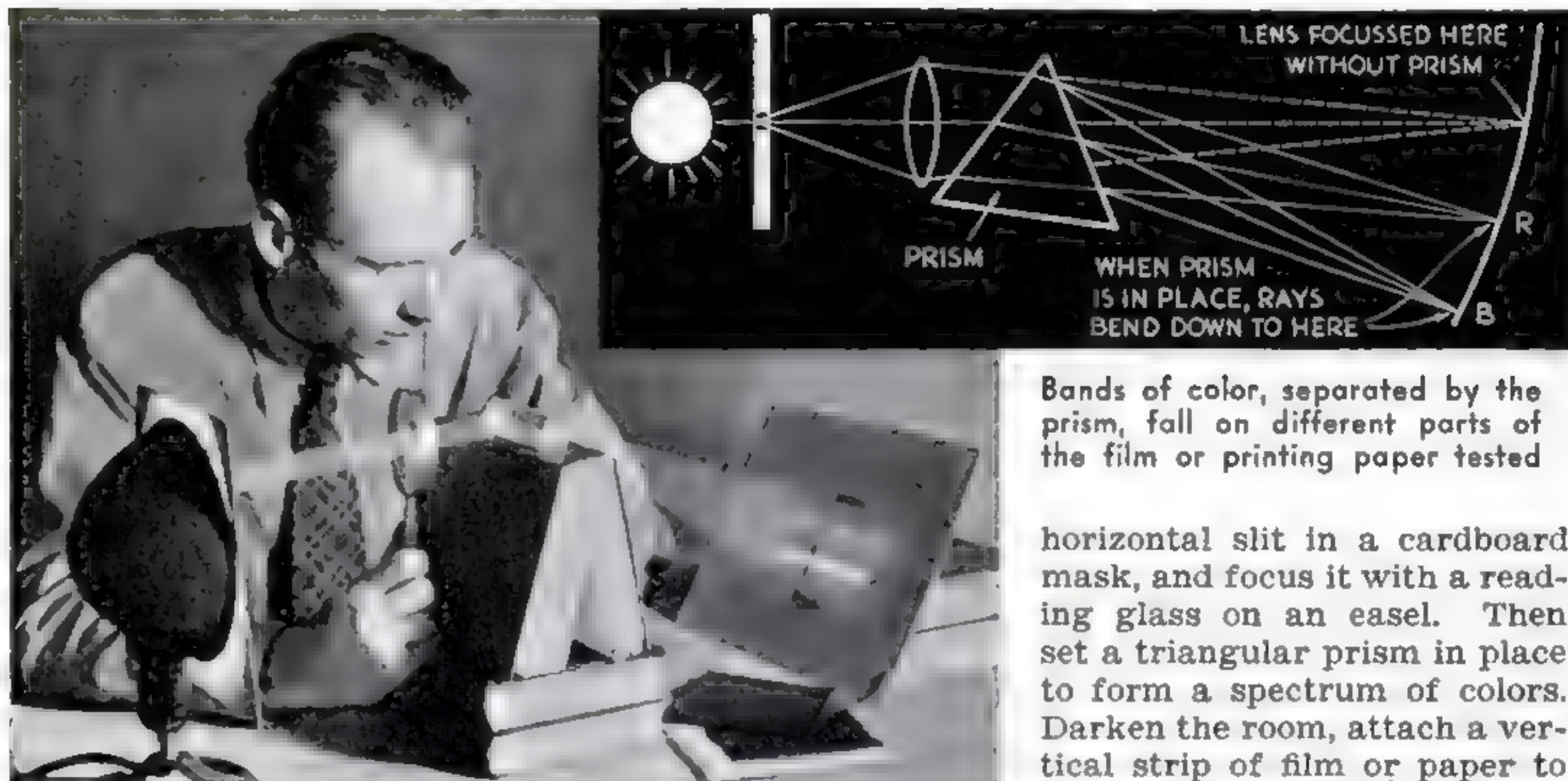
To demonstrate the flotation process of separating minerals, shake a pulverized mixture of galena and sand in water containing a drop of cresol. The oil frees the galena

Also punch a hole in the lid of the can, very near the rim, through which you can insert a glass tube. This tube should be about six inches long, almost half an inch in diameter, and sealed at one end. Half fill the tube with powdered aspirin tablets. With the sealed end inserted in the can, this apparently senseless accessory will serve as a temperature-indicating device!

Mount the "kiln" on improvised bearings, which may be drilled corks supported by laboratory stands, after filling it about a quarter full of powdered gypsum. Place a Bunsen burner beneath, with a flame-spreader attachment to distribute the heat. Start rotating the can, and adjust the burner flame until the aspirin in the glass tube remains molten, except for a small amount that solidifies in the exposed end of the tube. Since aspirin melts at approximately 135 degrees C., the gypsum within the can will then (Continued on page 242)

Laws of Science

Spectrum Tests Photo Films and Paper

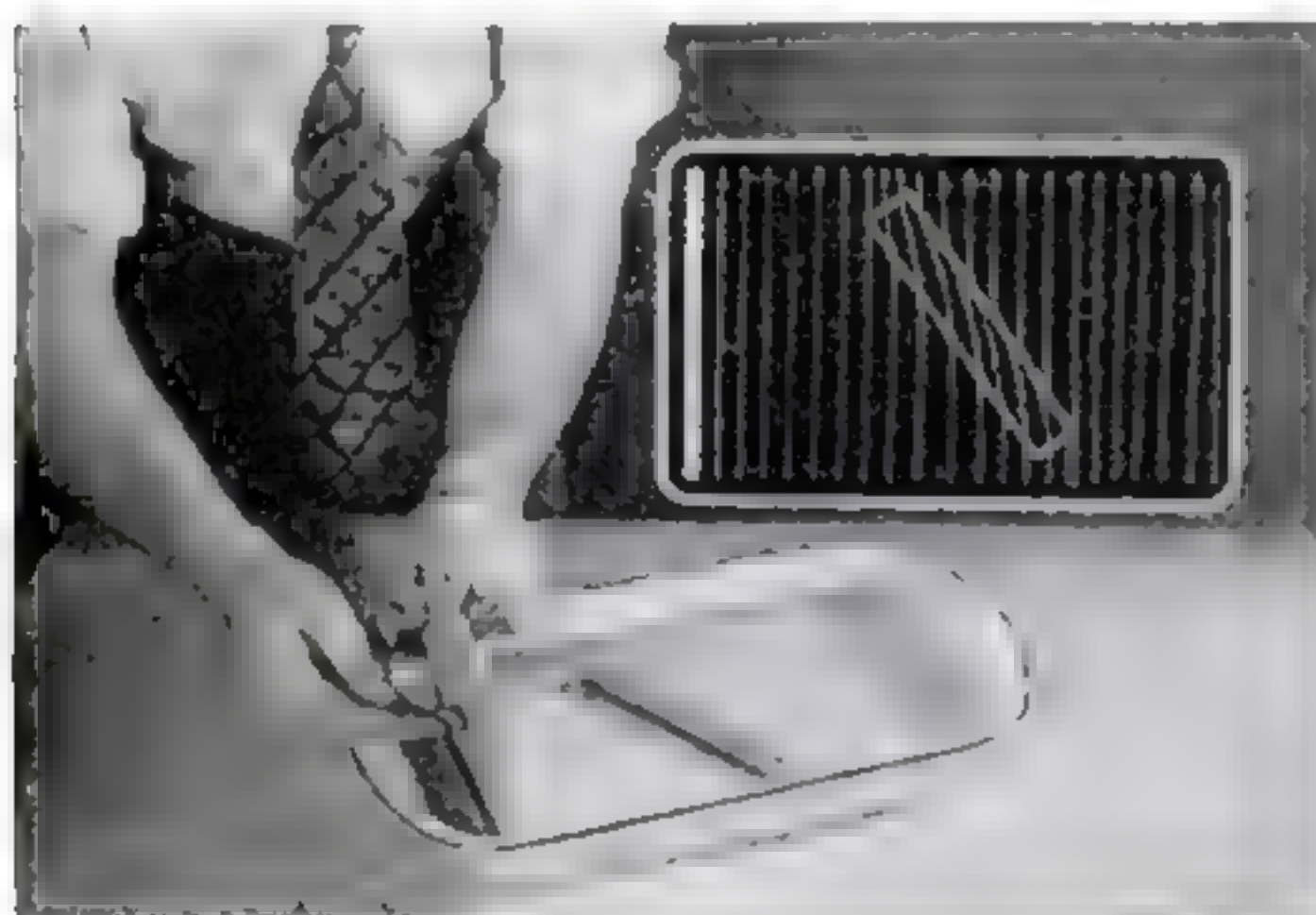


Bands of color, separated by the prism, fall on different parts of the film or printing paper tested

horizontal slit in a cardboard mask, and focus it with a reading glass on an easel. Then set a triangular prism in place to form a spectrum of colors. Darken the room, attach a vertical strip of film or paper to the easel, and turn on the light

TO COMPARE their relative sensitivity to light of different colors, you can test photographic printing papers and "color-blind," orthochromatic, and panchromatic films as shown. Let light pass through a

to make the exposure. The developed film or paper will clearly show which colors registered strongest. To make the spectrum band longer, move the easel farther from the prism and refocus the lens.



Iron "Short-Circuits" Magnetic Field

WITH an electromagnet or strong permanent magnet, support iron filings beneath a sheet of cardboard as shown. Insert a sheet of iron between magnet poles and cardboard, and the filings drop; sheets of wood, glass, brass, or plastics have no such effect. The iron "short-circuits" the field of force and acts as an effective shield for the magnetism that supported the iron filings.

Ripples "Refracted" by Obstacle in Water

SET a rectangular strip of glass or other material diagonally in an oblong pan, and pour in a little more than enough water to cover it. Tap a sheet of cardboard, as above, so that ripples run the length of the pan. The ripples bend, then straighten, as they pass the obstacle, much as light does in passing slantwise through a pane of glass with parallel sides.



Nonmagnetic materials do not cut the magnetic field

in Easy Tests



Homemade Electrophorus for Static-Electricity Tests

Drawings show how the touch of a finger, as below, draws off the negative charge, leaving the electrophorus with a positive charge

TO MAKE your own electrophorus, melt powdered sulphur and fill a coffee-can lid to the brim. When cool, smooth with sandpaper. Fit a smaller can cover, flat side down, with an insulating handle such as a penholder attached with sealing wax.

After rubbing the sulphur briskly with woolen cloth, set the small cover on it. Touch the top, withdraw your finger, and then lift the cover. It will be charged with static electricity and will attract pith balls and bits of paper, charge a Leyden jar, or discharge a tiny spark to your knuckle. Several recharges are possible before rubbing the sulphur again.



Why Steel Houses Keep Out Lightning

STAND a bird cage on books to insulate it. Place an electroscope inside, with wire connecting the ball to the cage. Connect the ball of a second electroscope, outside, to a corner of the cage. Now pass a spark from an electrophorus to the top of the cage. Leaves of the outer electroscope will fly apart; those of the electroscope inside remain unaffected, no matter how heavily you charge the cage. An electrical charge from outside cannot penetrate a space completely enclosed by conductors. In a thunderstorm, for the same reason, you are safer from lightning in a steel-framed building than in one of brick or wood. In your experiment, the bird cage became what is called a "Faraday cage."



The electroscope inside the cage is not affected by the charge

Exploring Insect Eyes



Looking through a dragon fly's eye lenses at the tip of a dissecting needle held beneath the stage

DID you ever wish, when you tried to cross a busy street, that you had a hundred eyes planted all over your head? If you want to get a general idea of what you would look like when so equipped, examine a dragon fly, honeybee, house fly, or moth; or a crawfish or similar crustacean. These creatures have whole batteries of eyes, so large that they cover much of their heads.

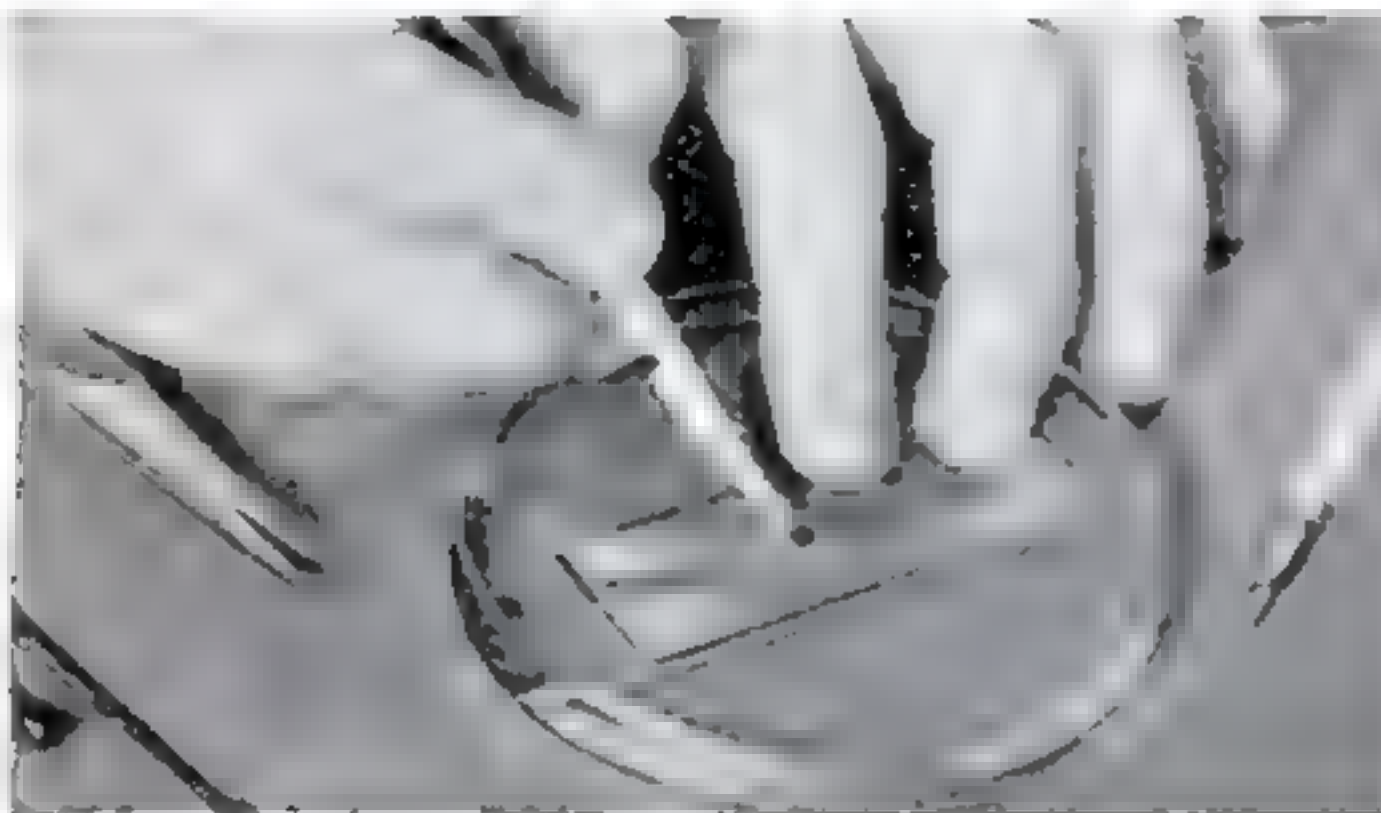
A dragon fly is one of the best insects to use when studying compound eyes. Other good specimens include moths, butterflies, and house flies. With a hand lens, examine the insect's head. You will observe two large, bulbous formations that cover much of the top, sides, and front of the head, and that sometimes come together at the center. These have a metallic sheen that may be of a black, brown, or purplish color. You can distinguish something of the external structure of these two compound eyes, and see that they are made up of hundreds and hundreds of tiny facets.



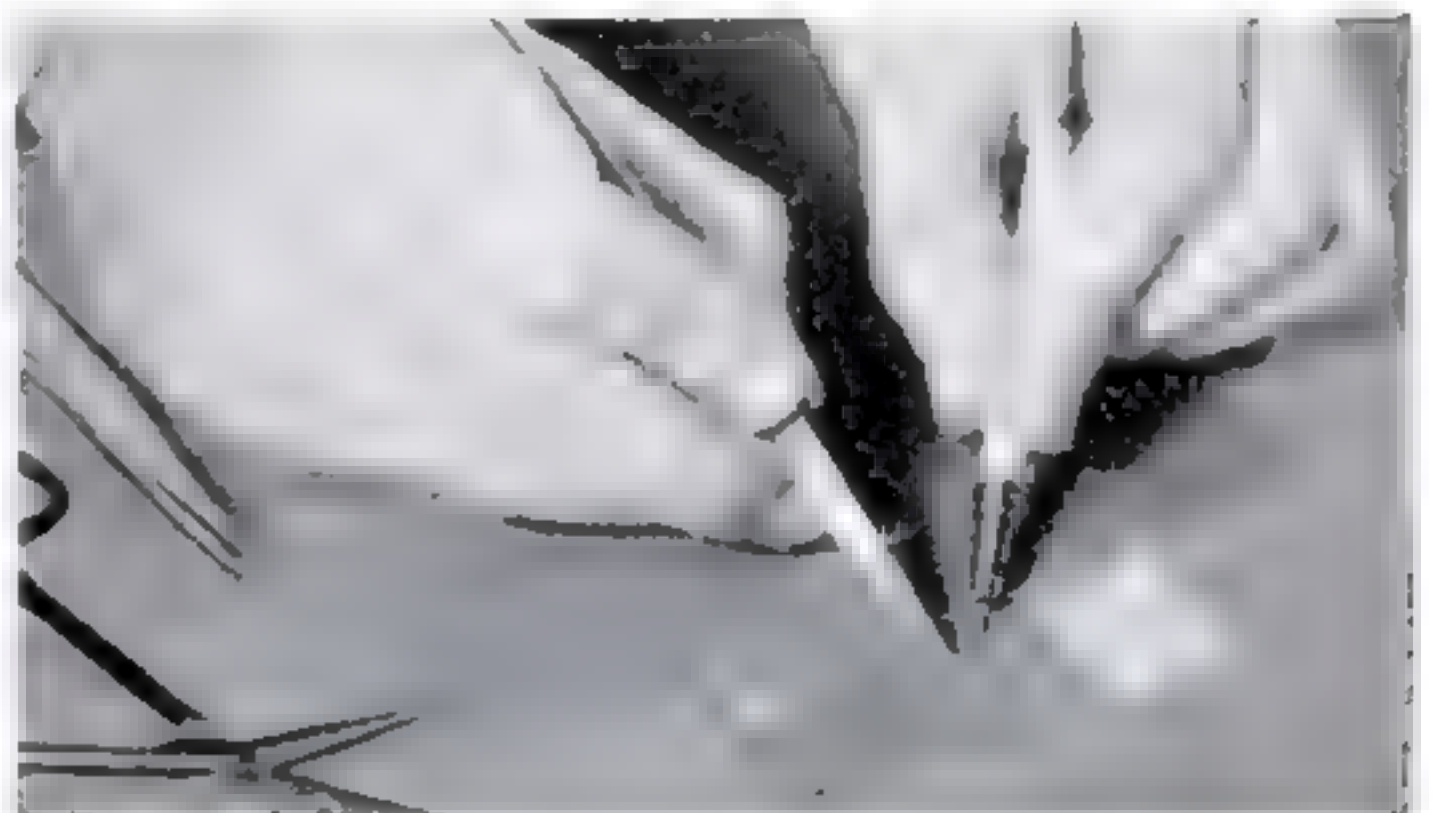
To make a cast of the surface of an insect's eye, spread a drop of liquid collodion on it. After the collodion has hardened, peel it off with tweezers



For dissecting the eye, you can stick an insect's head on a slide. Here the slide is being warmed to soften the wax in preparation for setting the head



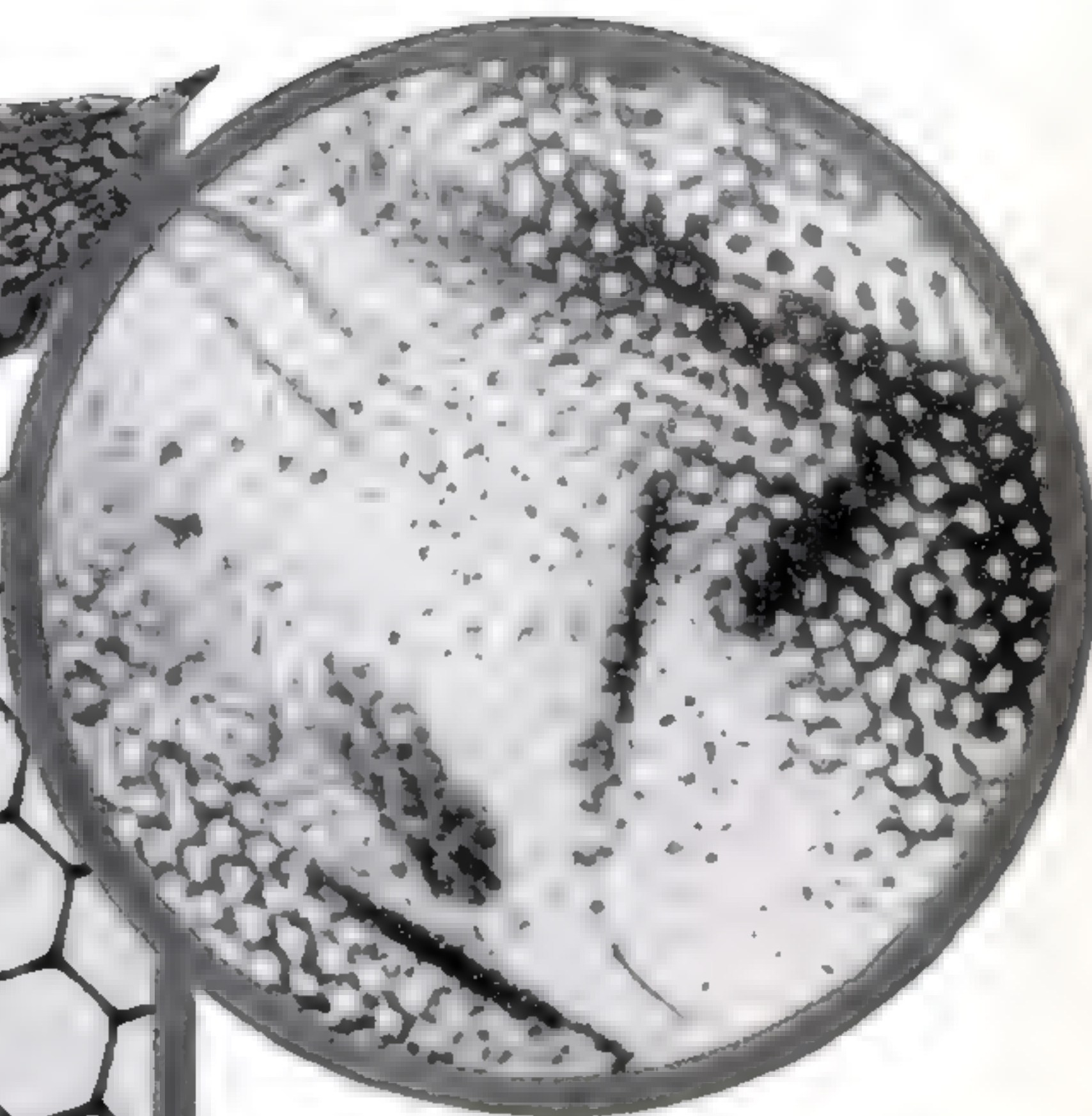
With the cooled wax holding the head firmly, the eye can be dissected under water. As you peel the cornea back, you will find it hard, like gristle



Because the corneal layer is hemispherical and springy, it is necessary to make several slits in the edges so it will flatten out without splitting

with Your Microscope

The prominent "eyes" of this beetle are fakes. Its real eyes are smaller



Photomicrograph of a collodion cast of the eye of a moth, showing impressions made by scores of tiny lenses. At left, the facets themselves. Note the uniform hexagonal shape

Remove the head from the insect, either by cutting or simply pulling it off, and place it on a glass slide. Examine the eyes with your microscope set at a low power. Use strong light coming from a point above and to one side of the stage. You find that the facets making up the eyes are amazingly regular in size and shape, and that they are generally hexagonal, a form that permits them to nestle together with no loss of space. In some compound eyes, like those on certain crustaceans, the facets are square.

You are looking at the corneal layer, a transparent membrane that is broken up into numerous tiny lenses, one for each eye. Research has indicated that each lens is really a combination of two plano-convex lenses with their flat surfaces together. The indices of refraction of these lenses are different, probably to provide better images through reduction of aberrations. Thus the insect, millions of years ago, was using an optical principle that man, comparatively recently, "discovered" and is using to make the lenses of mi-

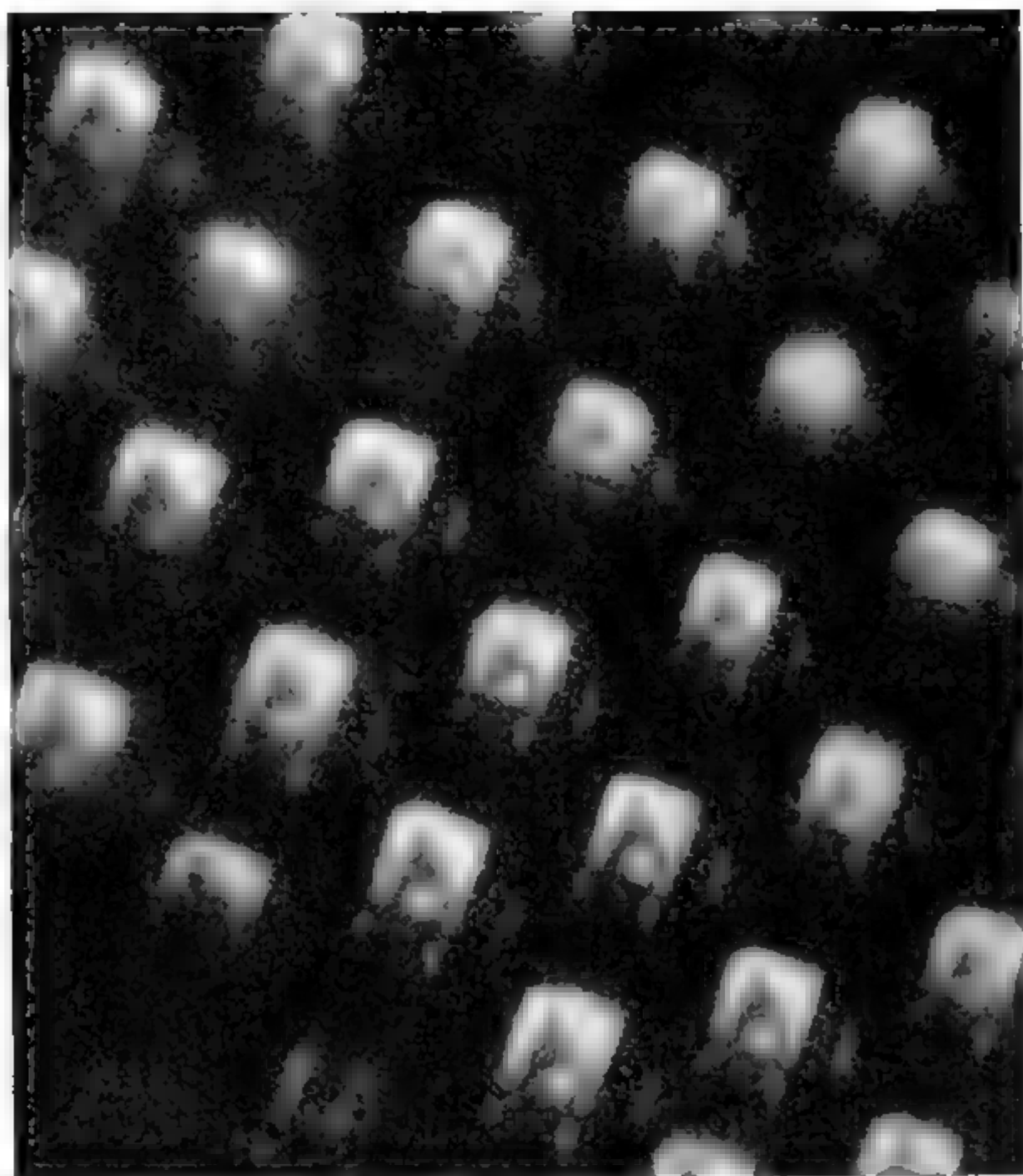
croscopes, cameras, telescopes, and other optical instruments perform better.

The compound eye of an insect is, as its name indicates, made up of many individual eyes, each complete in itself. Beneath each outer lens is a transparent pyramid or cone, its base outward and its apex pointing inward. The apex connects with a fiber running to the optic nerve. Each eye is separated from the ones next to it by black, opaque pigment; and this pigment is used beneath the surface of the cornea to keep out light, except where it enters through the tiny pupil.

In each eye, light, to affect the optic nerve, must travel through the transparent spot in the cornea and strike a similar spot at the apex of the cone. Light rays entering at an angle that makes them miss the apex are absorbed by the black pigment.

Thus, with each of its eyes, an insect sees only a limited portion of an object. The eyes next to that eye see also a limited area, but one slightly different. With several thousand such restricted images that merge or overlap, the

By
**MORTON C.
WALLING**



This is a bee's-eye view of a small microscope silhouetted against a window. Each lens produces an image

insect obtains a complete view of the entire scene.

Since the compound eyes cover so much territory on the insect's head, and are curved so that their individual eyes sweep large angles, the view is evidently much more extensive than that provided by the human eye. Compound eyes may not produce as sharp an image as the eyes of higher animals, but they enable the owner to detect movement in almost any direction; and it probably is movement of an enemy that interests an insect most.

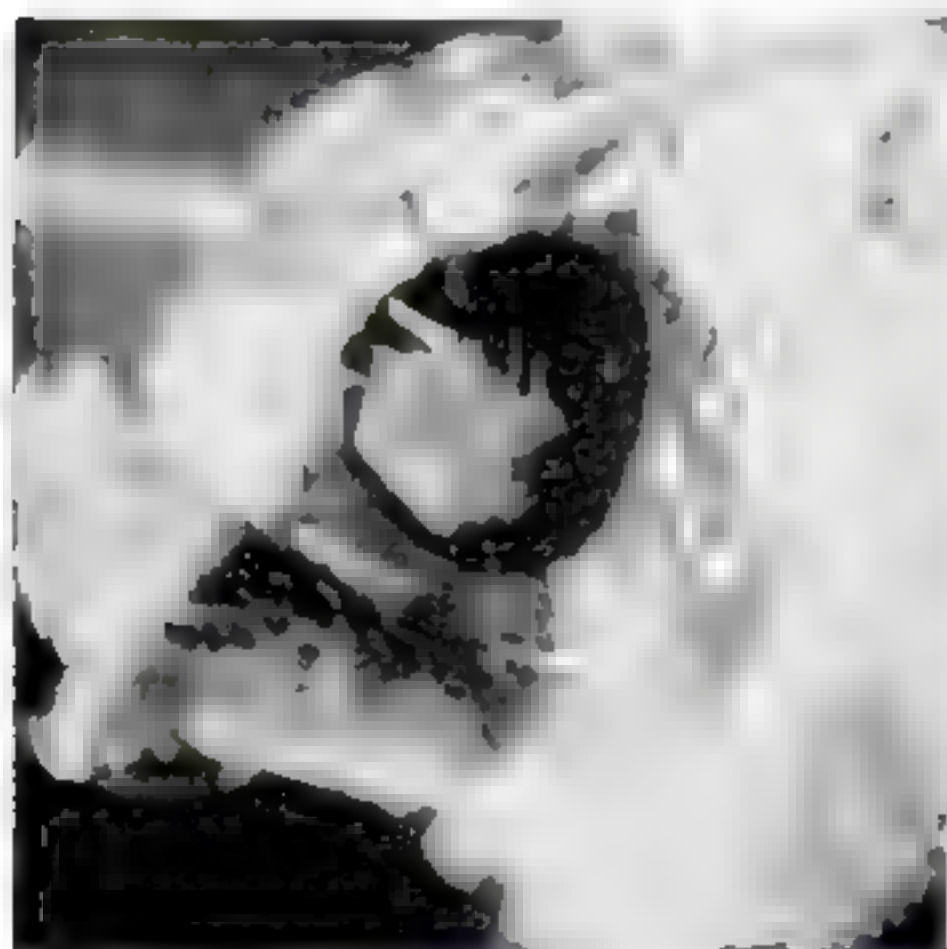
Although you will find it difficult to prepare sections through an insect eye that will reveal the structure of the conical units, without going through the routine of embedding in paraffin and sectioning with a microtome, you can learn a lot and have considerable fun with the cornea. Examination with a hand lens and the lower powers of your compound microscope suggest that the outer surface is not smooth, but has a definite texture.

Without the need of even dissecting the eye, you can prove this to be true. Obtain, from a drug store, an ounce or so of liquid, flexible collodion. With a pointed stick or dissecting needle, place a drop of this on the compound eye of a dragon fly or some other insect that does not have a lot of hairs scattered over the eye. Spread the collodion into a thin layer, and let it harden. Then, with fine-pointed tweezers, peel it off and transfer the film thus obtained to a slide.

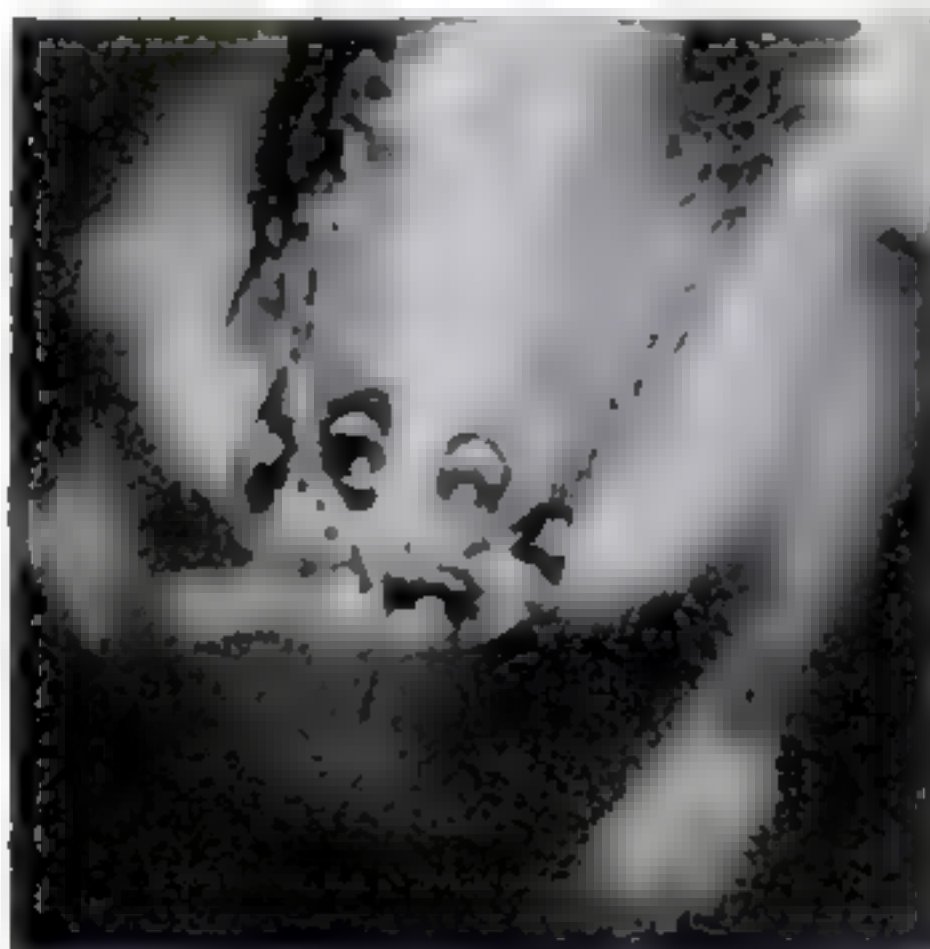
Examine this collodion cast with your microscope, and you will find that it contains a faithful impression of every facet that it covered; and

that each impression is a tiny hollow, made by the outward-curving surface of the cornea. In making such collodion casts, you can add some alcohol-soluble dye to the liquid collodion, to make it easier to see.

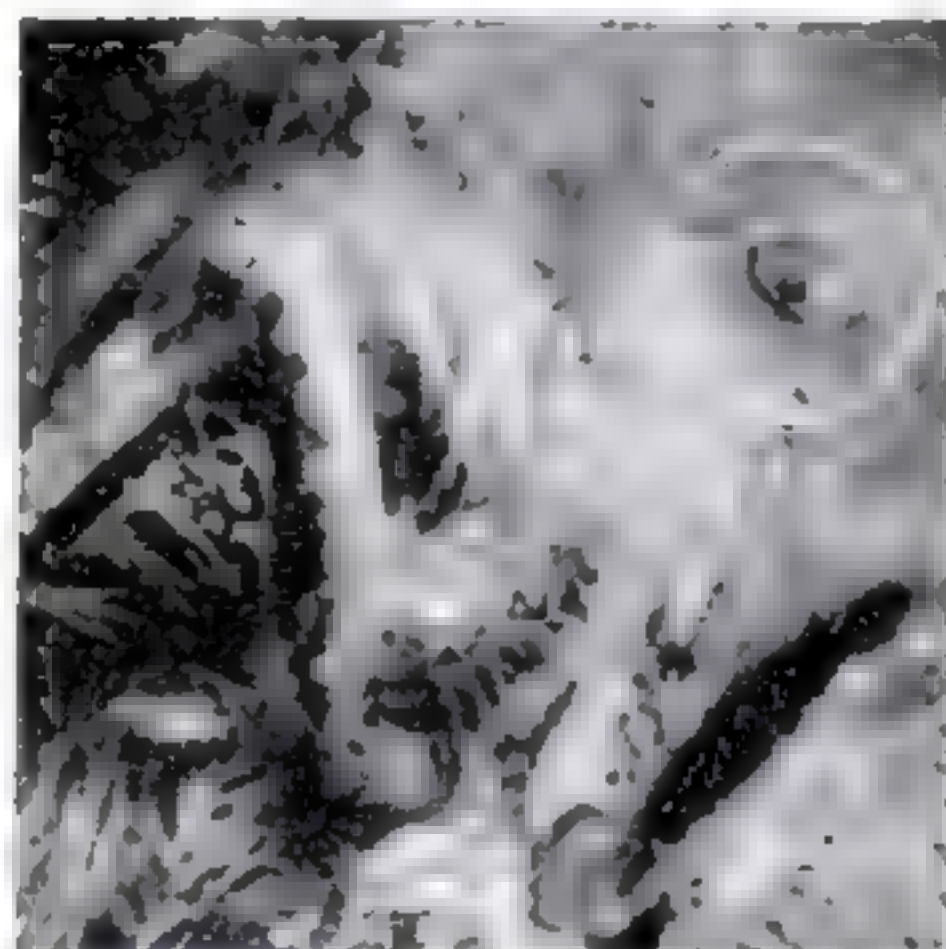
For a better conception of the lens layer of a compound eye, remove the cornea with the aid of sharp-pointed scissors or a scalpel. You can hold the head with tweezers, or stick it to a glass slide with the aid of some melted paraffin or beeswax. Let the wax harden, and then proceed to cut around the edge of the compound eye. This dis-



Compound eye of a moth. The dark surface is hundreds of lenses. White spot is a body scale



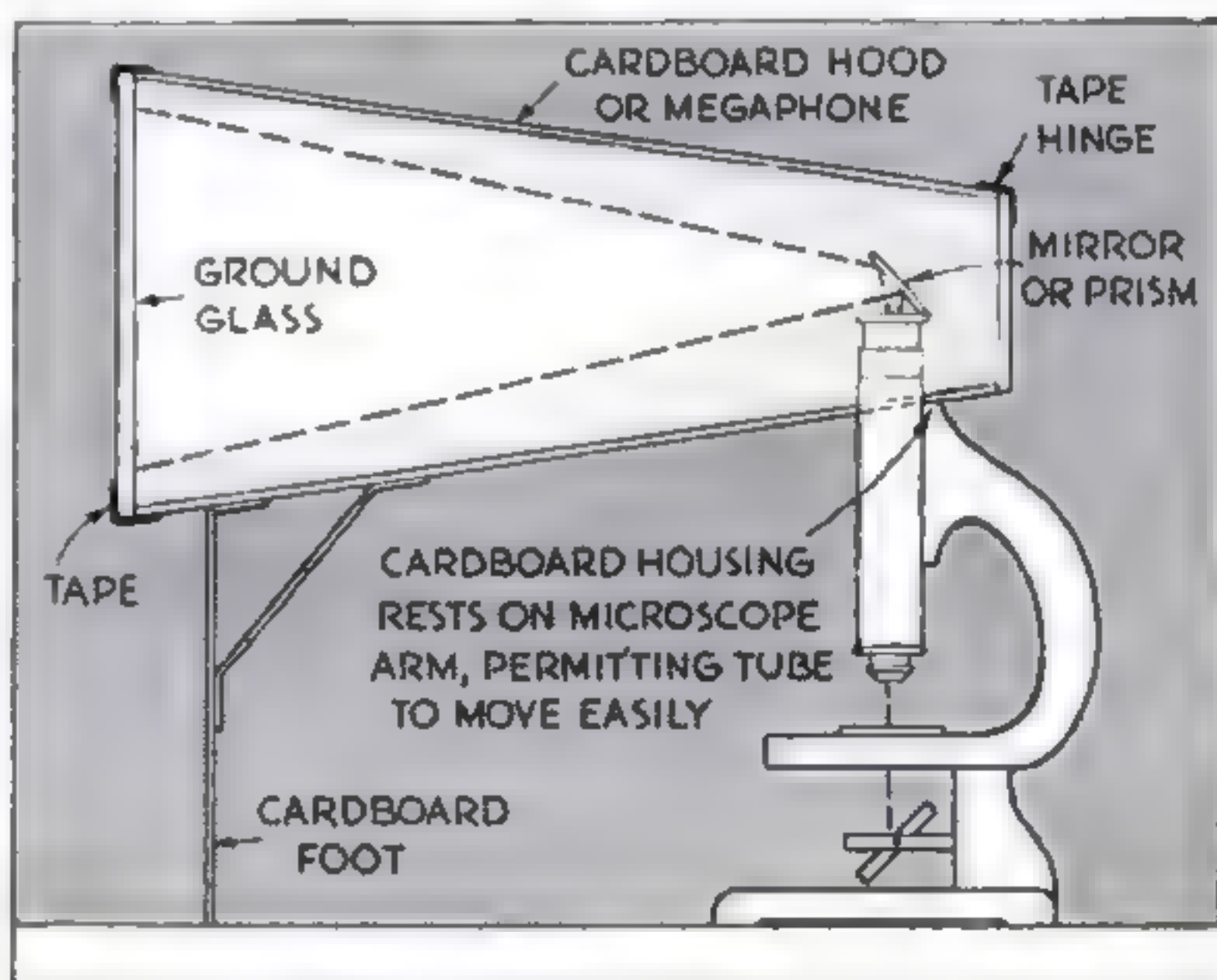
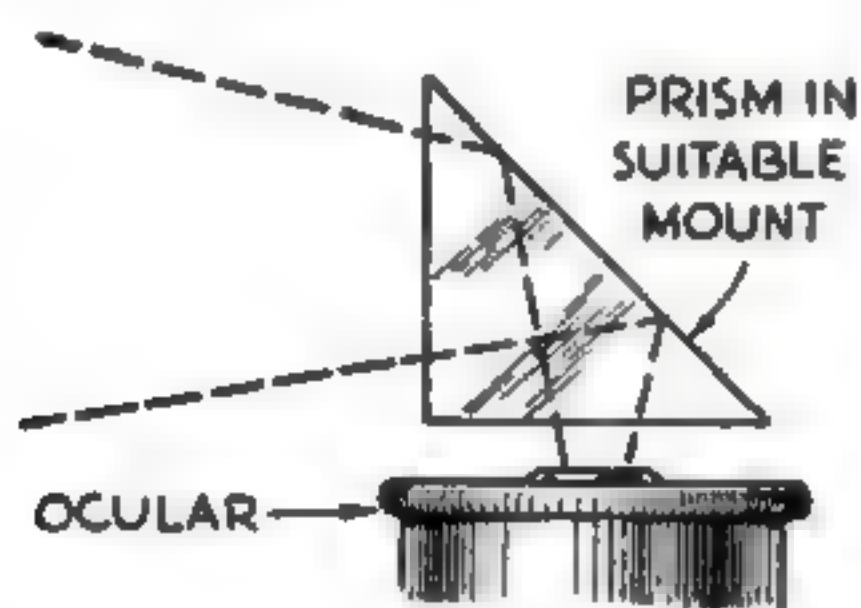
The spider does not have a compound eye, but carries a battery of individual eyes on its head



Top of a honeybee's head, showing a compound eye and one of the single eyes (seen in circle)

Build This Simple Microprojector

A SIMPLE microprojector that can be made for almost nothing is shown in the drawings. It consists of a light-tight cardboard housing with a ground-glass screen at one end. The image formed by the microscope is projected on the screen with the aid of a mirror or prism mounted on the eyepiece. You can make the housing from a cardboard megaphone, by cutting off some of the mouth-piece end and providing a hinged cap for it, and fitting a circular piece of ground glass over the large end. Or you can build the housing from sheet cardboard, and shape it to take a square piece of ground glass. Cut a hole near the small end to admit the microscope tube. Although a piece of ordinary mirror mounted at a 45-degree angle to the surface of the eyepiece lens will serve to reflect the image on the screen, a first-surfaced mirror or a right-angled prism is better adapted to giving a clear image on the ground glass.



secting should be done under water. Peel back the cornea. You will find that it is tough and hard, like gristle.

The corneal layer will be in the form of a hemisphere or spherical segment, such as you obtain when you peel a large piece of the skin from an orange. Being tough, it resists the pressure necessary to flatten it so you can focus on more than a few of the facets at once. By making several slits with fine-pointed scissors or a knife around the edges, you can flatten the specimen without causing it to wrinkle or split in the center.

The corneal layer will have black pigment adhering to its inner surface. To remove this, hold it with tweezers in a beaker

or watch glass of water, and with a small camel's-hair brush twisted back and forth between the fingers, scour out the pigment.

For temporary observation, place the eye layer in water under a cover glass. Examine it, also, without water or other medium. For permanent mounting, dry and mount in balsam. Some microscopists recommend soaking the cornea for a few days in turpentine, followed by washing in xylol or dioxan, before mounting in balsam.

You will find, upon focusing your microscope on the mounted corneal membrane, that it is made up of numerous tiny lenses capable of forming images just as a camera lens does. You even can focus these lenses on various objects, *(Continued on page 246)*

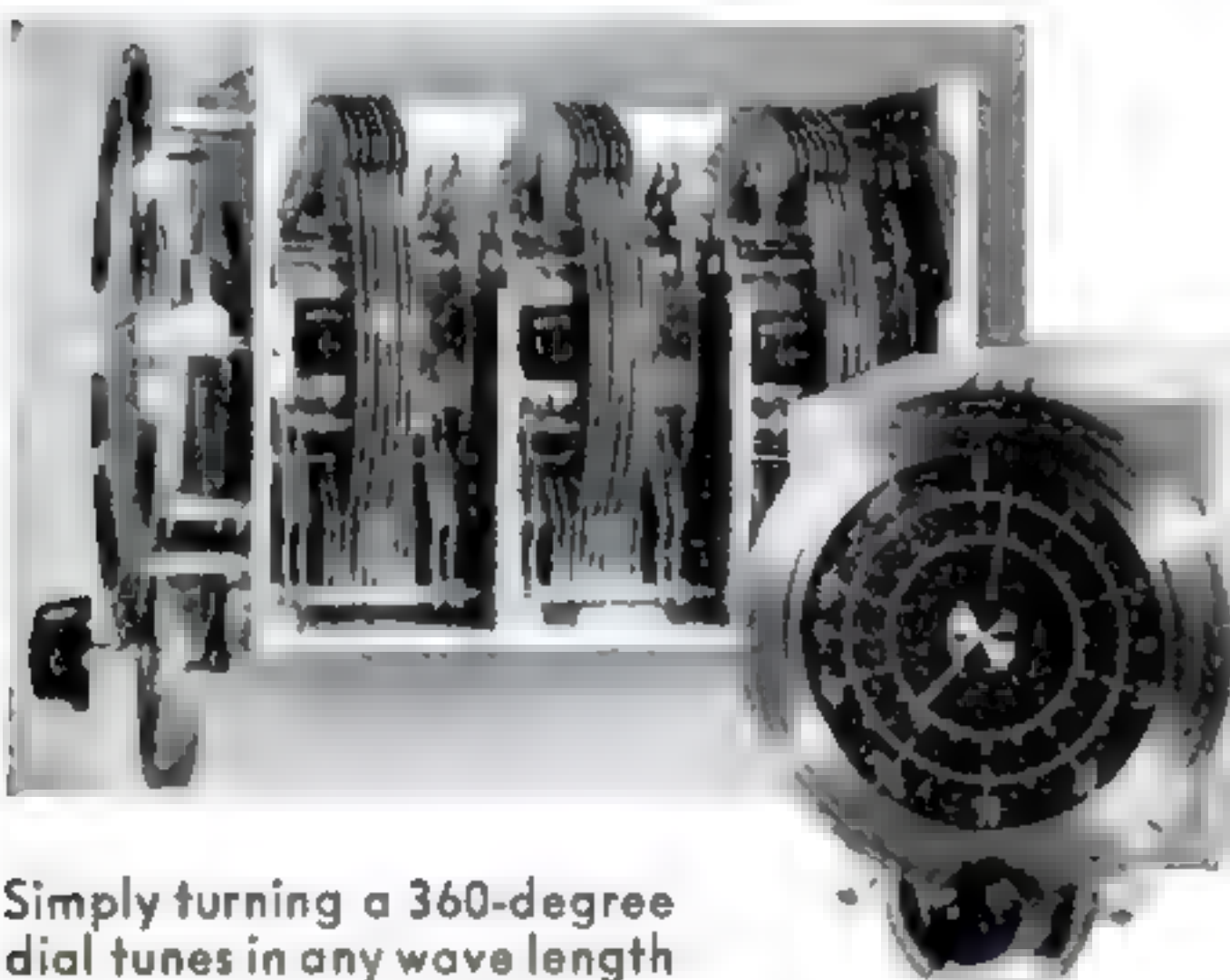
NEW DEVELOPMENTS



Phonograph, radio, and piano work through a common amplifier

Radio, Phonograph Built into Bench of Electric Piano

THREE forms of musical entertainment are available in a single instrument, illustrated in the photograph at the left, that takes up less room than an ordinary upright piano. The instrument comprises an "amplifier piano," an electric phonograph, and a radio. The piano action is contained in the main unit, which also houses an electric amplifying hook-up and a loudspeaker. The phonograph, with its automatic record changer, and the radio, are built into a sturdy bench styled to match the piano. All three music sources operate through the one amplifying system, contained in the main unit.



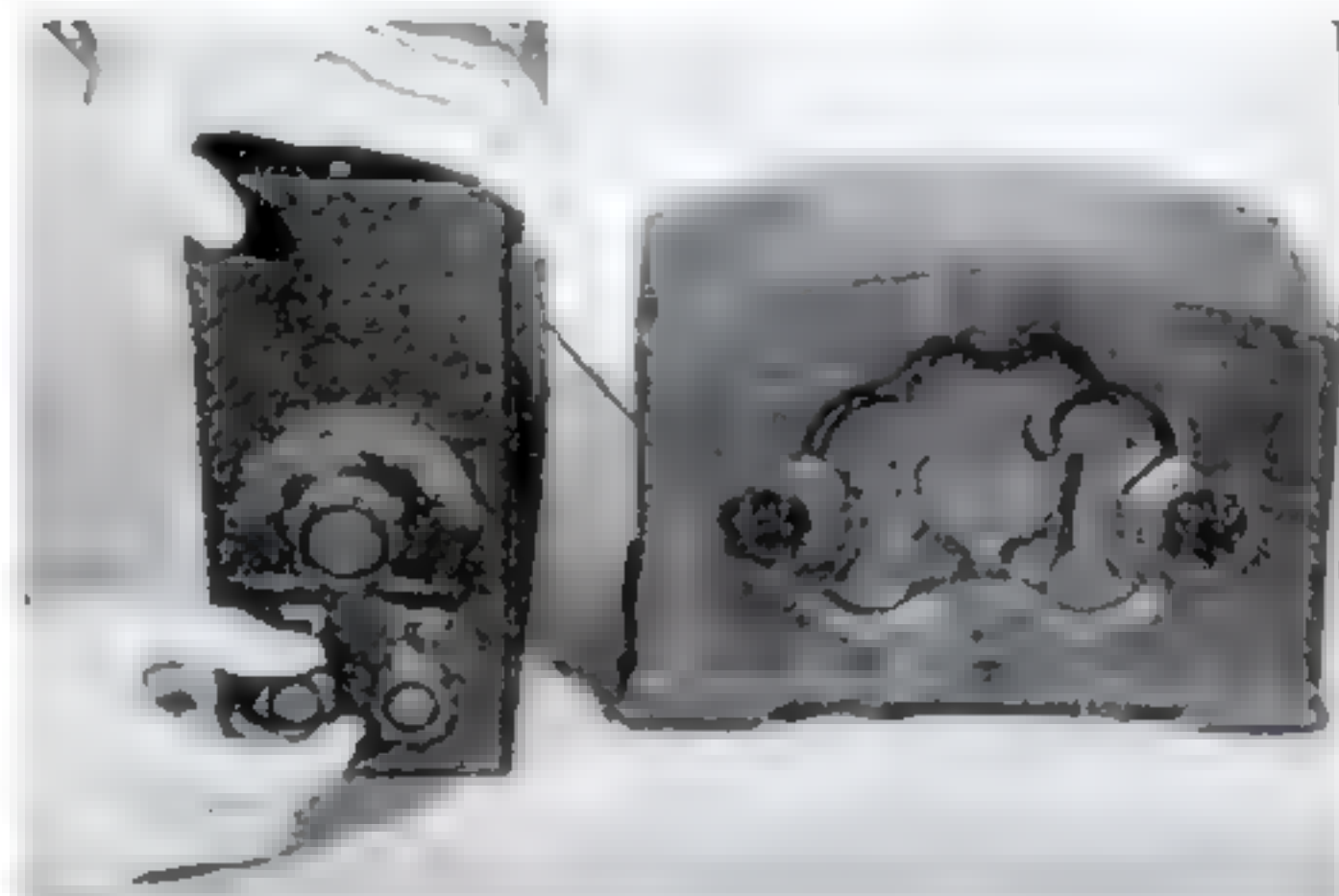
Simply turning a 360-degree dial tunes in any wave length between five and 550 meters

Low-Frequency Converter for Standard-Band Sets

FOR receiving weather broadcasts and other long-wave programs, the handy converter illustrated is designed to attach directly to any broadcast-band receiver of good design that will tune to 1,550 kilocycles. A handy switch enables the operator to cut the converter in or out. The unit is designed for either alternating or direct current at 115 volts, and has its own tuning dial for selecting stations in the low frequency, or long-wave bands.

Automatic All-Wave Tuner

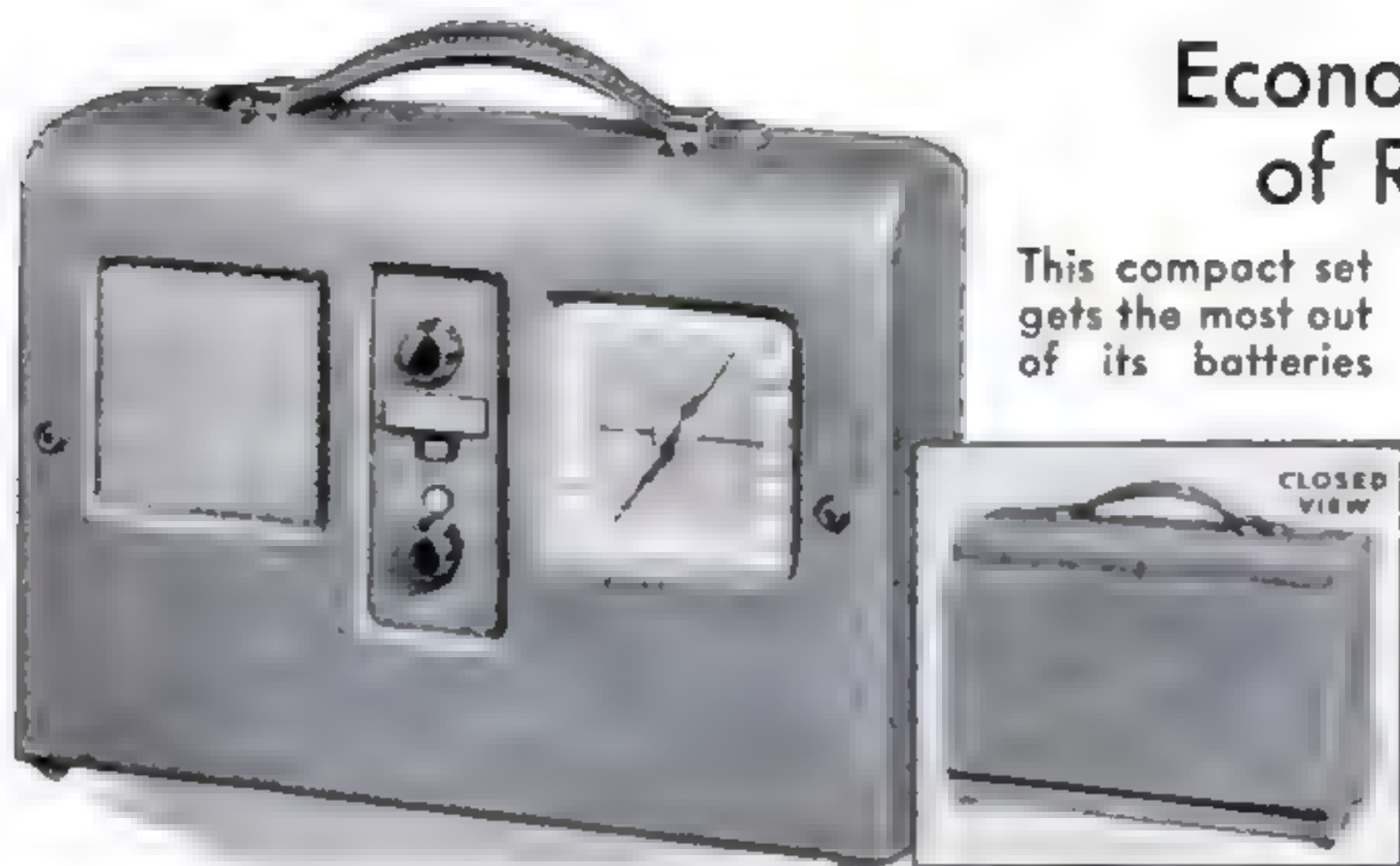
AN ALL-WAVE tuning assembly for set builders, in which tuning is done simply by twirling a dial through a full turn to bring in stations throughout the various frequency ranges from five to 550 meters, has just been introduced. There is no gang switch to be set when changing from the broadcast band, for example, to short or long wave, the assembly providing smooth transition from one band to another.



The converter in use with a standard-band receiver

FOR THE RADIO FAN

Economizer Lengthens Life of Receiver's Batteries



This compact set gets the most out of its batteries

CUTTING electric consumption as much as fifty percent when maximum power is not required, a lightweight, portable radio receiver incorporates an ingenious device which can be turned on at will to add hours of service to the set's built-in batteries. A detachable snap-on cover is moved to the back of the case when the set is in use.

"Radio-Newspaper" Set Available As Kit

WITH all working parts carefully machined to insure easy assembly, materials in kit form for constructing a "radio-newspaper" receiver to attach to your present radio have just been marketed by a well-known radio manufacturer. When assem-

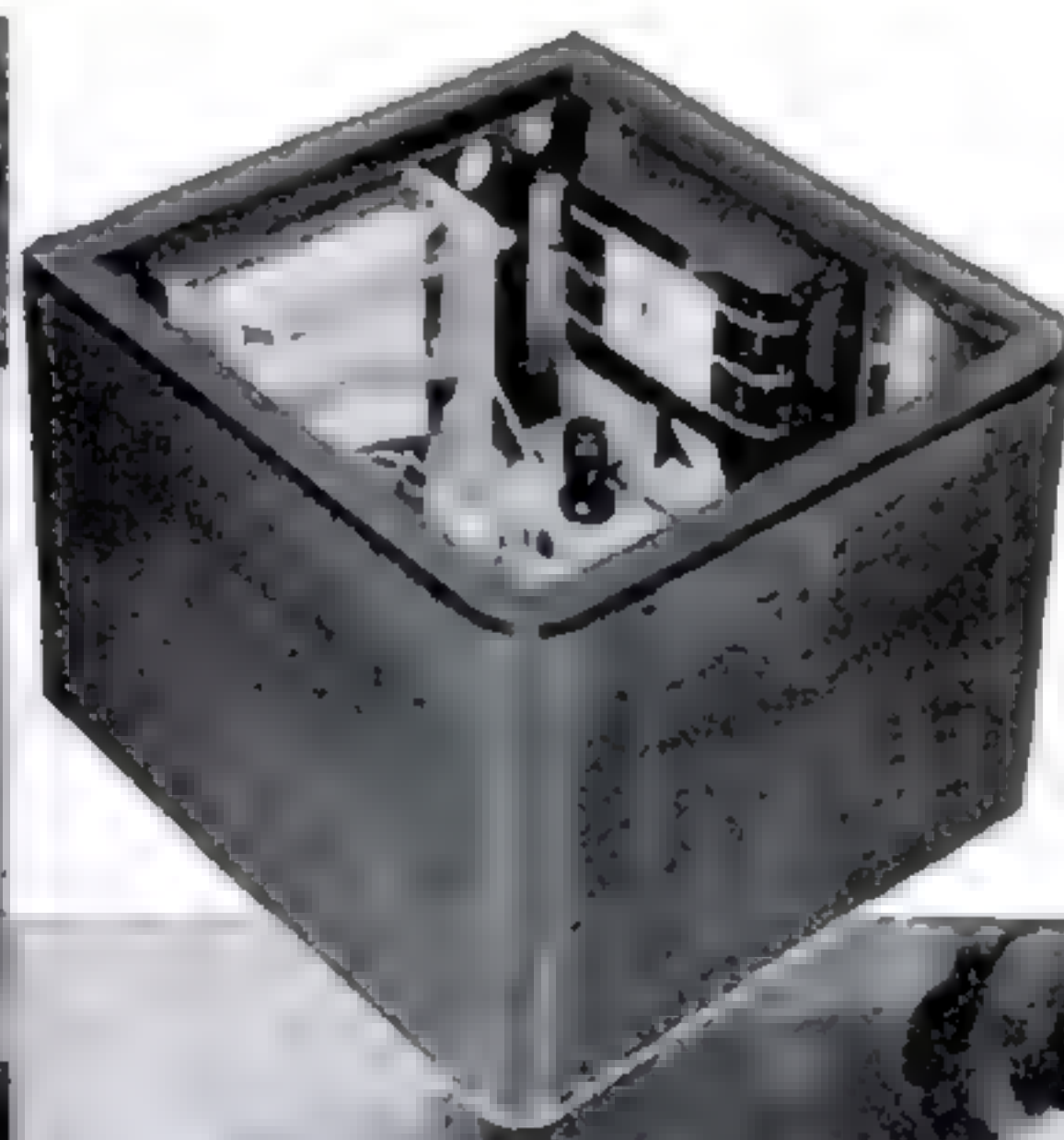
bled, the unit is identical in detail with the built-up "radio-newspaper" receiver sold commercially. The kit includes a complete set of instructions to aid the amateur radio builder in assembling the set with the least possible trouble. If desired, a special clock

is furnished which can be built into the mechanism to turn the set on and off to coincide with the regular scheduled "newspaper" broadcasts. In addition to the clock, a cabinet may be obtained with the kit. Several views of the outfit are shown in the accompanying illustrations.



Reading a news bulletin from the facsimile receiver. Upper right, the set after assembly

Right, stamped-out, machined parts are all supplied ready to be put together according to the printed instructions



Week-Enders' Radio

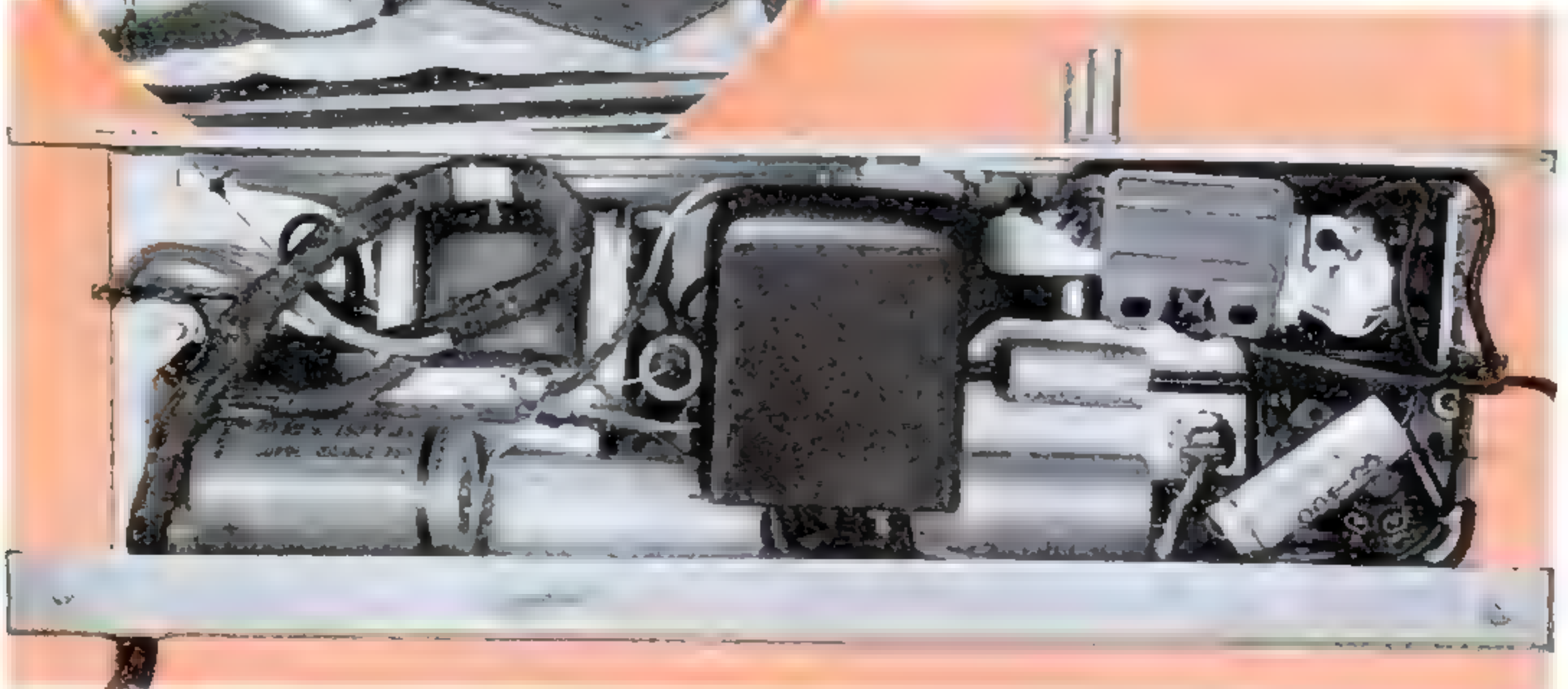
By
FRANK TOBIN

• •



Attractively finished, the portable radio shown in use above is designed to fit like a tray in the overnight case, ready to be removed and plugged into an electric outlet

Note the simplicity of controls and the airplane-luggage fabric covering. How the parts are arranged beneath the U-shaped chassis is shown in the photograph below



Fits in Handy Overnight Case

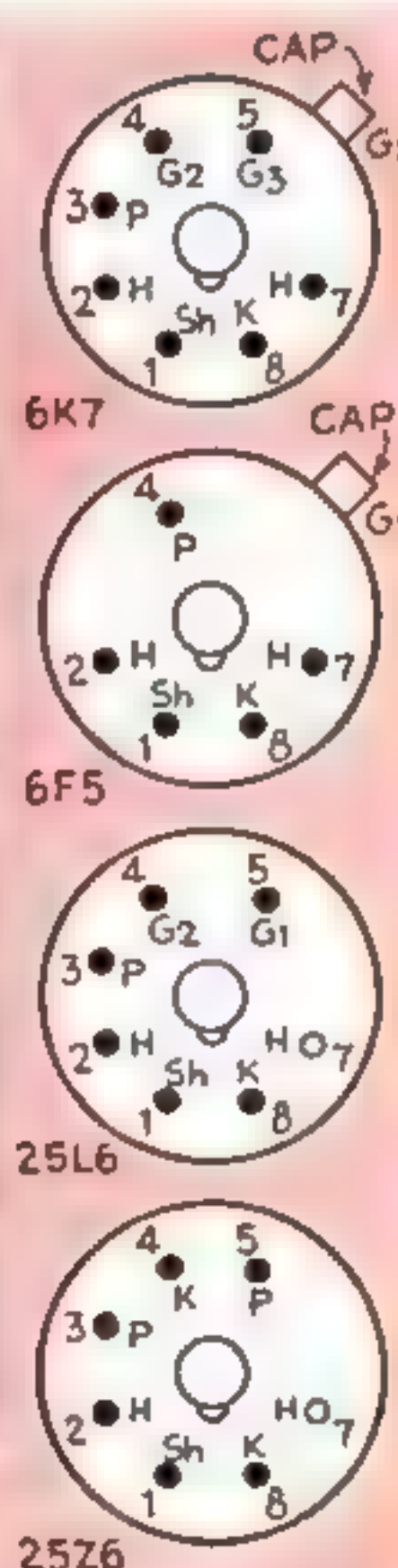
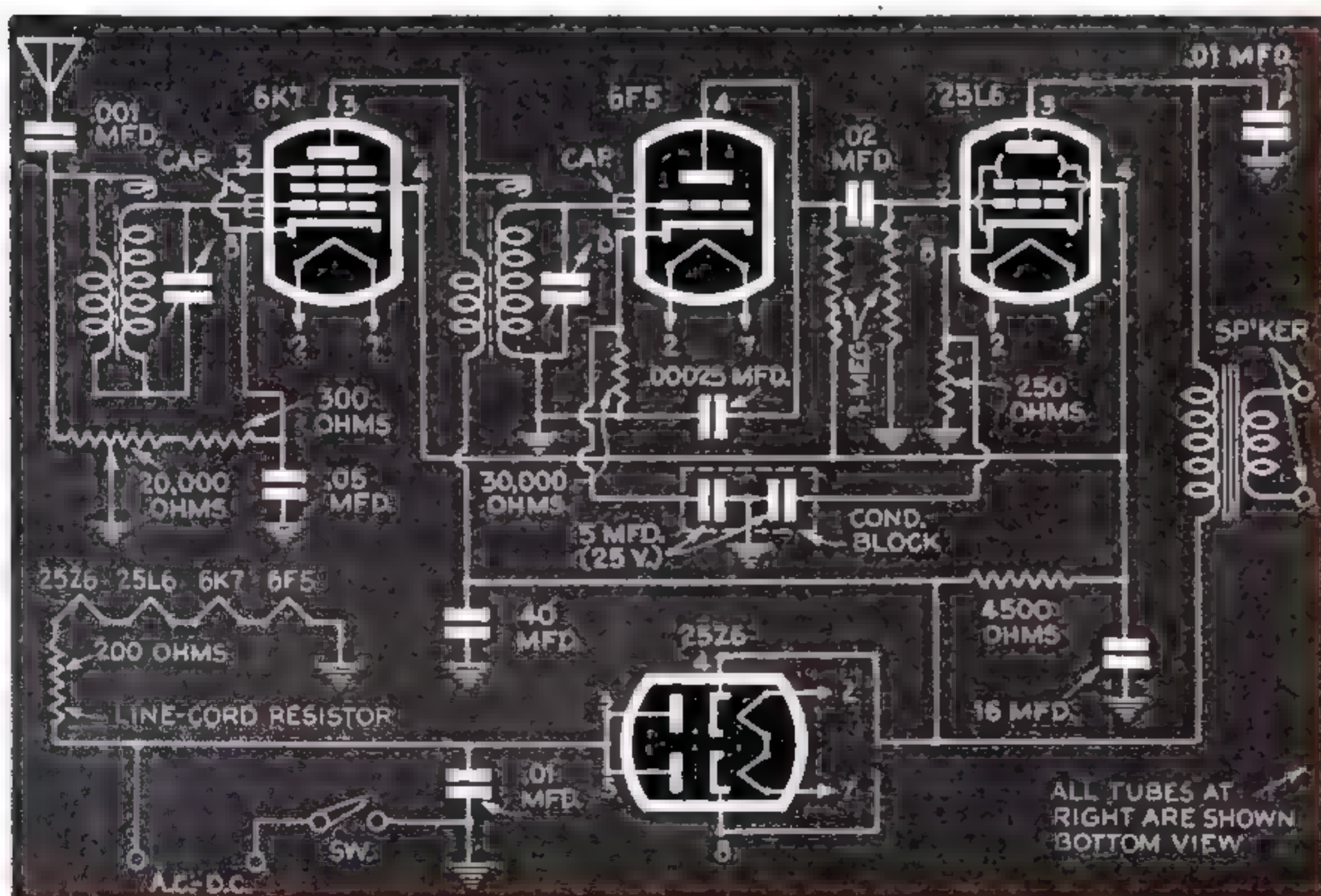
PROVIDING good volume and selectivity, the compact four-tube, A.C.-D.C. receiver illustrated will appeal to week-end travelers who like to take their radio entertainment with them, for it is more than just an ordinary portable set. Besides its own cabinet, it has a neat overnight luggage carrier into which it slips along with your toilet articles and the few apparel necessities for a short trip. You can build the suitcase and its radio-cabinet "tray" yourself, according to specifications on the next page, or have them made up at your local luggage shop.

Although a standard, four-tube, tuned-radio-frequency circuit is used, changes have been made to increase the set's efficiency. Iron-core coils for example, are used because of their greater selectivity and higher gain; while in the detector stage, one of the new "high-mu" triodes replaces the conventional high-frequency pentode. The triode provides better quality and can be operated to give a high signal output without distortion. For the output tube, a new beam power pentode, a 25L6, was chosen since it can be used without any added resistors or by-pass condensers, although care must be taken to use a cathode resistor of proper value.

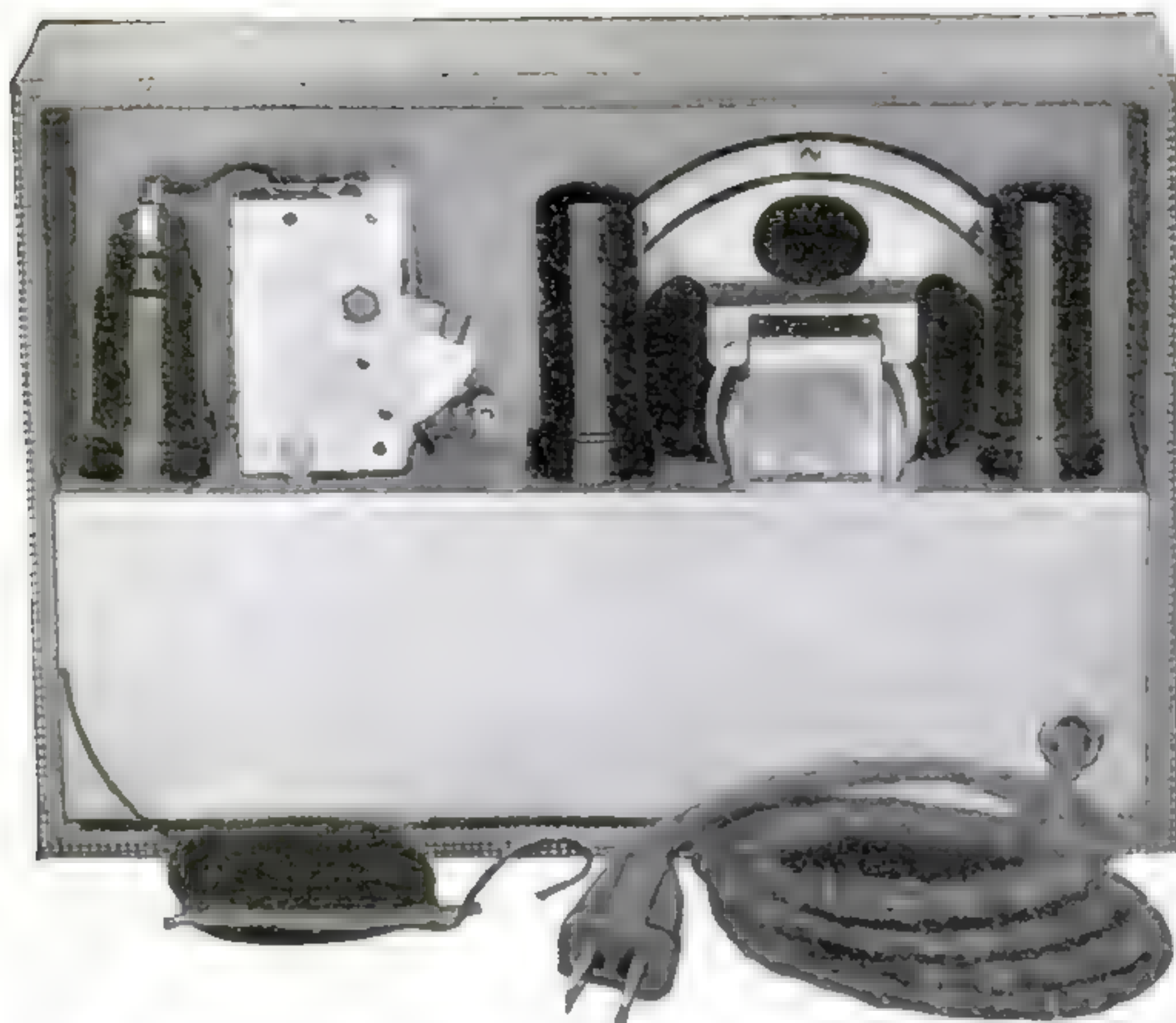


After packing the week-end bag, the receiver is set in place and the lid closed down for carrying

Instead of a filter choke, a 4,500-ohm, one-watt resistor is employed to save space and keep down the cost. To avoid overheating of the resistor, the plate current of the



All connections for the A.C.-D.C. radio are given in this circuit diagram, while the sketches of the tube bases at right show how the tubes should be wired



At left, parts mounted on top of the chassis, and the assembly as it fits inside the narrow cabinet. The finished set appears above, and specifications for the cabinet, case, and chassis below

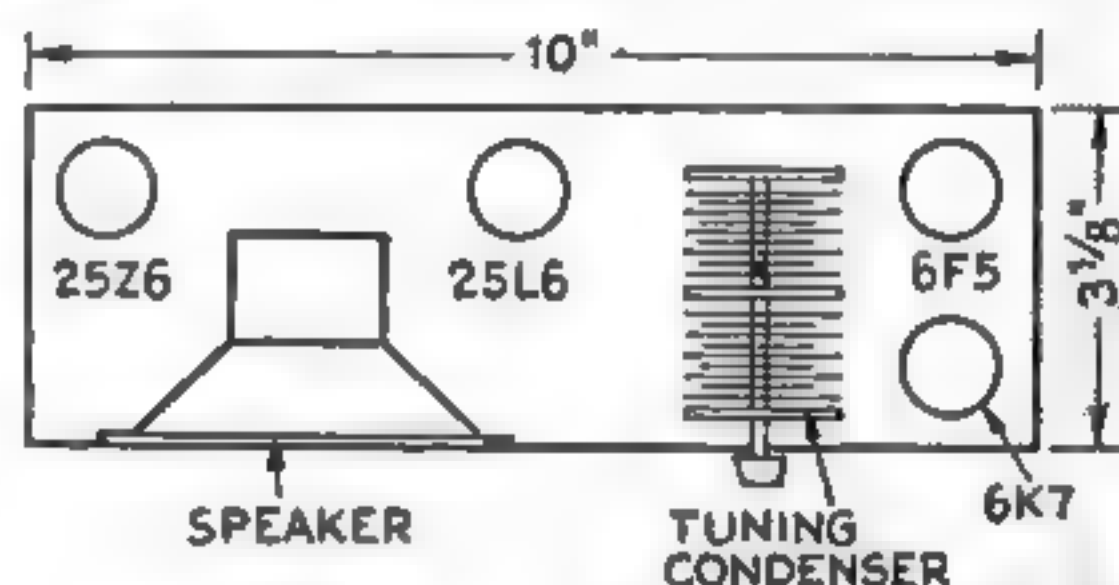
25L6 tube is taken directly off the cathodes of the rectifier. To eliminate any possibility of hum due to this arrangement, a high-capacity (40-mfd.) electrolytic condenser must be used for filtering this part of the rectifier circuit.

A five-inch electrodynamic speaker was chosen instead of the usual permanent-magnet type, as the former costs less and is more sensitive to weak signals.

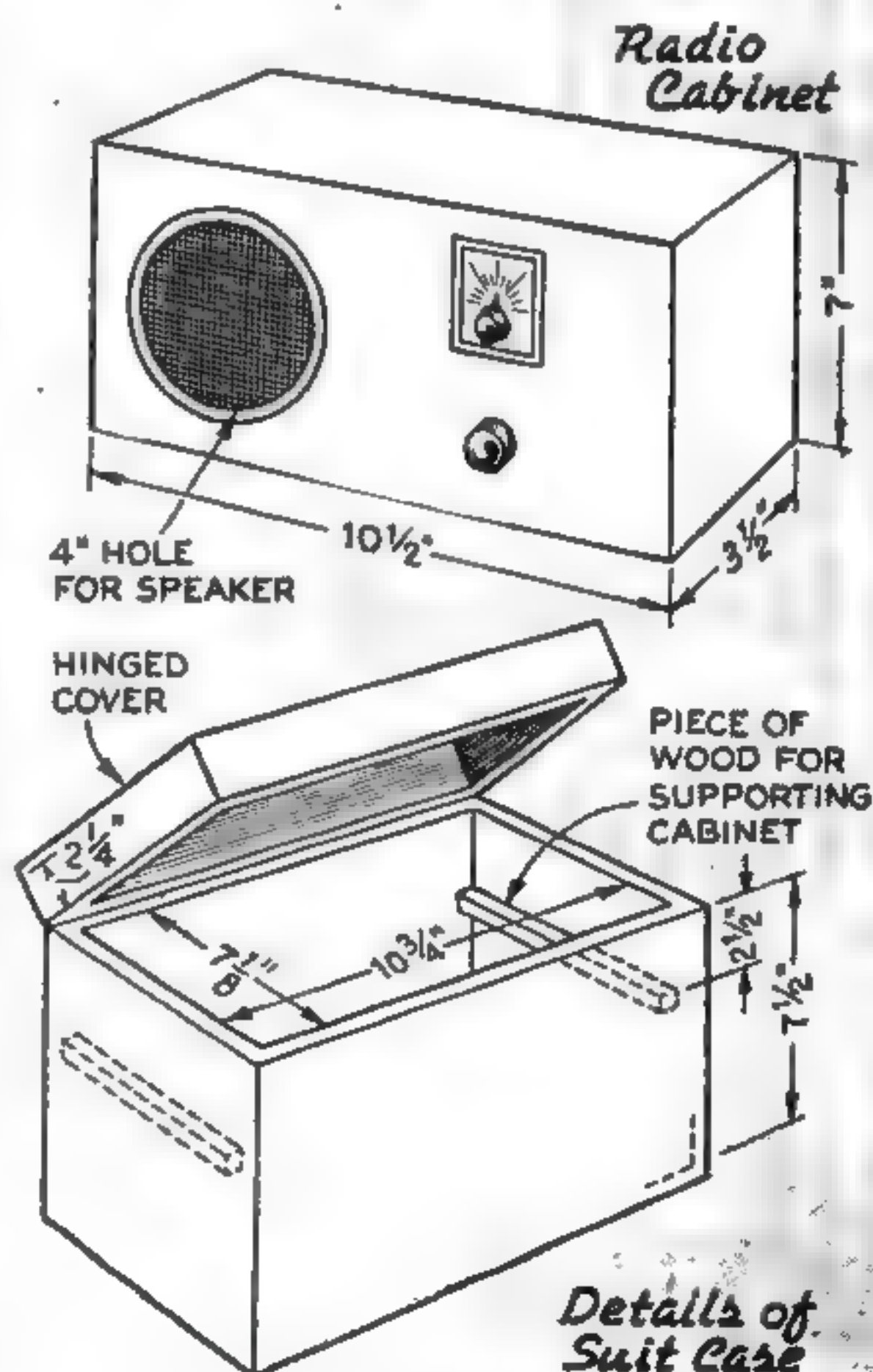
In laying out the chassis and cabinet, arrange the parts as shown in the illustrations so the receiver will be shallow enough to fit in the "tray." The tuning dial and knob harmonize with the color of the fabric, while brass locks and hinges were selected so that they would not rust. As the panel of the radio extends above the open suitcase, it is a simple matter to lift the set in and out.

LIST OF PARTS

Five-inch electrodynamic speaker.
 Iron-core antenna coil.
 Iron-core radio-frequency coil.
 Volume control, 20,000 ohm, with switch.
 Line-cord resistor, 200 ohm.
 Resistor, 250 ohm, $\frac{1}{2}$ watt.
 Resistor, 300 ohm, $\frac{1}{2}$ watt.
 Resistor, 30,000 ohm, $\frac{1}{2}$ watt.
 Resistors (two), 1 meg., $\frac{1}{2}$ watt.
 Resistor, 4,500 ohm, 1 watt.
 Two-gang tuning condenser, .00036 mfd.
 Mica condenser, .00025 mfd.
 Mica condenser, .001 mfd.
 Tubular electrolytic condenser, 5 and 5 mfd., 25 volt.
 Electrolytic condenser, 16 mfd., 150 volt.
 Electrolytic condenser, 40 mfd., 150 volt.
 Tubular condensers (two), .01 mfd., 200 volt.
 Tubular condenser, .02 mfd., 200 volt.
 Tubular condenser, .05 mfd., 200 volt.
 Miscellaneous:— Four octal sockets; four tubes (6K7 radio-frequency pentode, 6F5 high-mu triode, 25L6 output pentode, and 25Z6 rectifier); chassis, wire, etc.



Layout of Chassis



Details of Suit Case

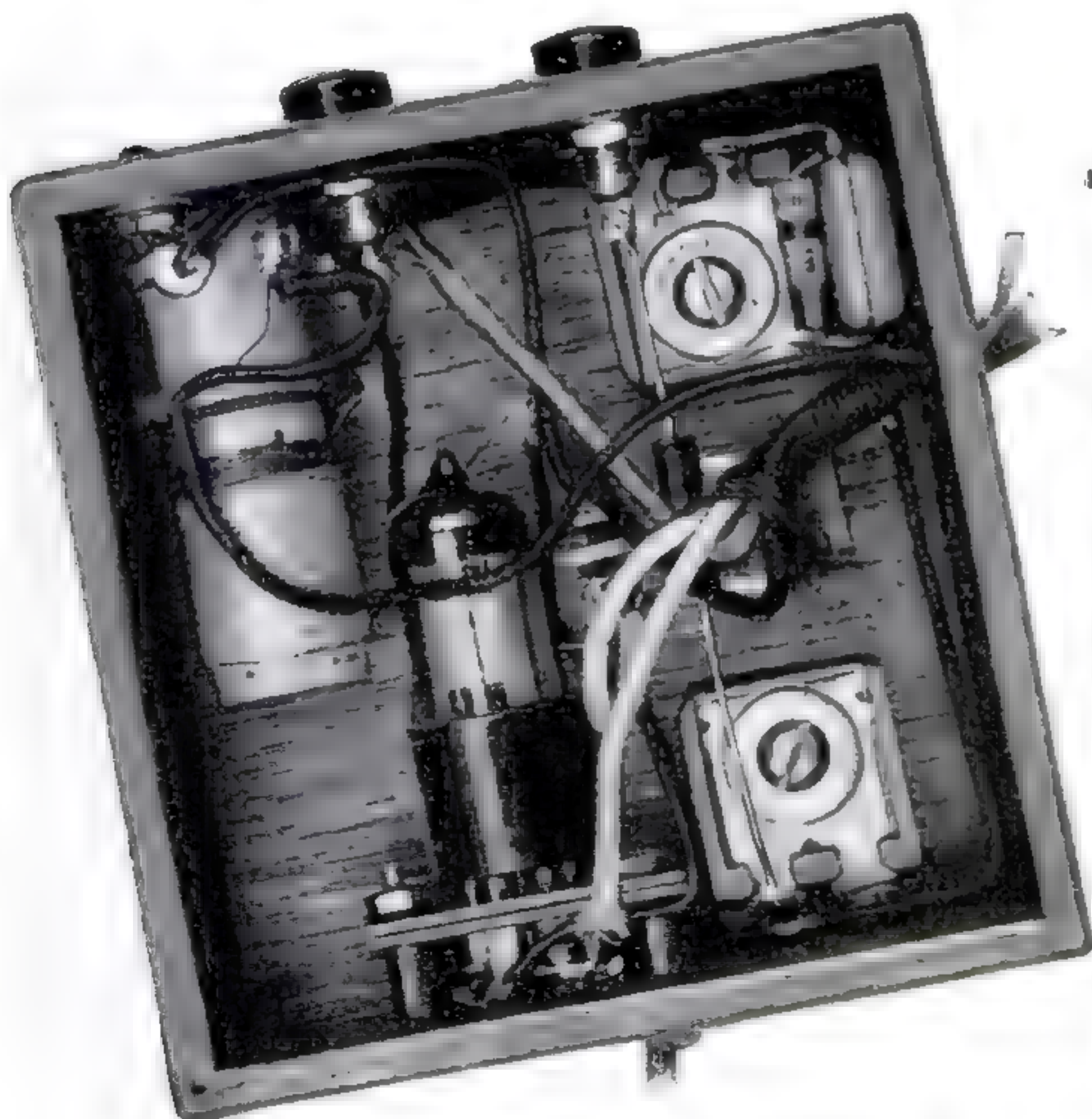
Book-Light Radio

MOUNTED on the bracket of a book light, this tiny broadcast receiver will be found extremely useful while reading after you've gone to bed. Earphones, two small batteries, aerial, and ground complete the set. Instead of the usual radio-frequency choke in the plate lead, a 10,000-ohm, half-watt resistor is used, while a padding condenser with a maximum capacity of .0004 mfd. forms the tuning condenser. A similar padding condenser is used as a regeneration control. The tuning coil (L_2) is a midget-type antenna coil such as used in A.C.-D.C. receivers, wound with thirty turns of double-silk-covered wire around the lower end. This unit comprises the ticker coil (L_3).

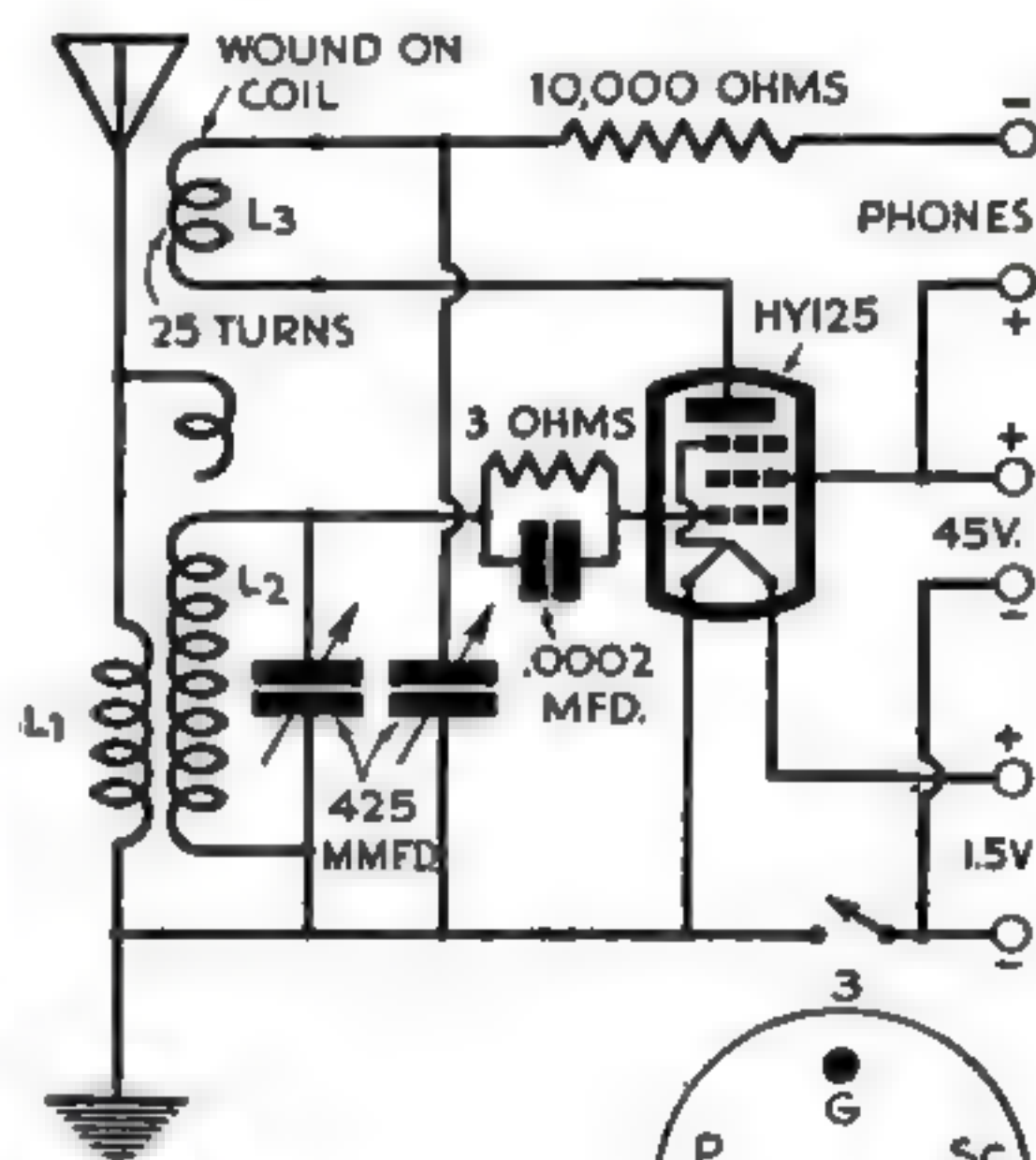
The cabinet is $\frac{3}{8}$ " thick walnut, $1\frac{1}{2}$ " by $3\frac{1}{2}$ " by $3\frac{3}{4}$ ", glued together and shellacked. Fiber board may be nailed on the back, and the unit fastened to the stem of the book lamp with a single bracket.



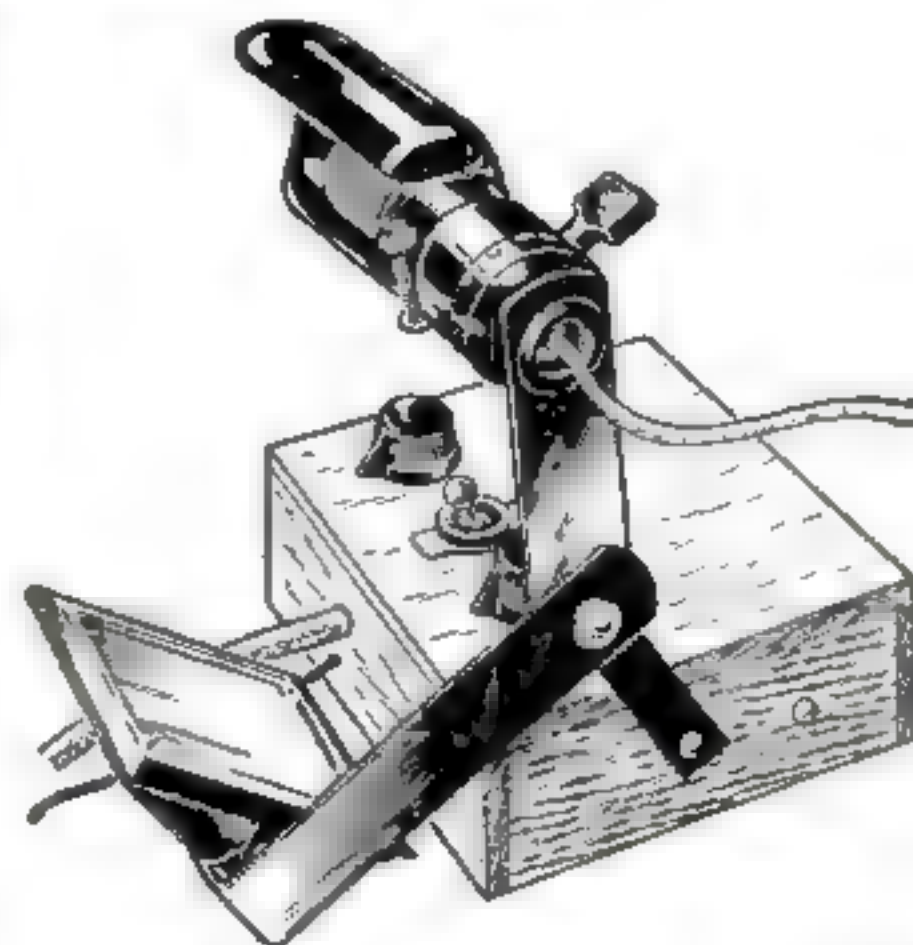
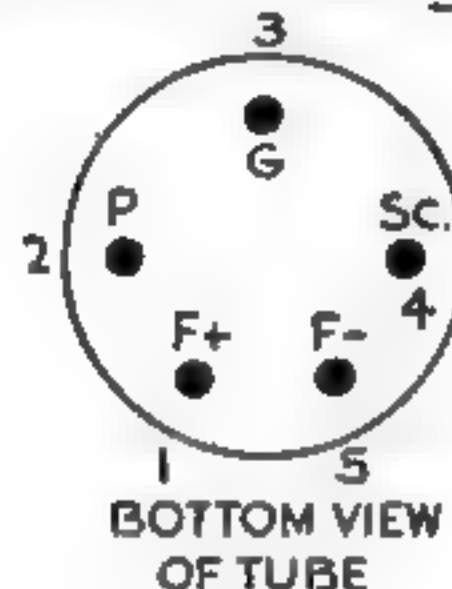
Controls are handy as you read with this radio turned on



Padding condensers replace the usual-type tuning condensers. Note cabinet details at right



Details of the circuit are shown in diagram. Its tiny $1\frac{1}{2}$ -volt tube uses a 45-volt "B" battery for plate current



Hints for the Motorist

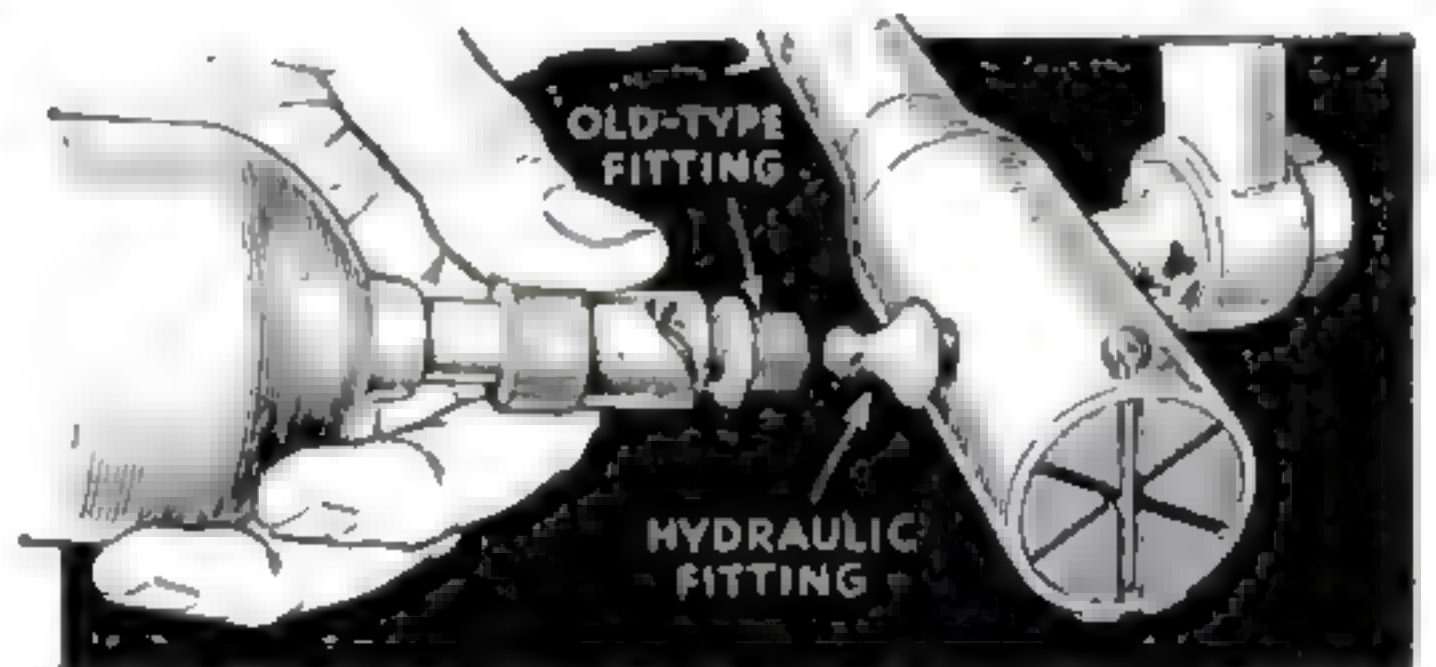


Mirror and Headlamp Make Shaving Easy

CAMPERS and automobile tourists who sometimes have to shave at night without adequate lighting can save themselves an ordeal by attaching a small rear-view mirror of the inexpensive auxiliary type to one of the car headlamps by its rubber suction cup. The correct position for the mirror is in a line between the bulb and the shaver's eyes, so that the shadow of the mirror falls across his eyes and allows him to see, while the headlight illuminates his face.—D.S.

Using an Old Grease Gun on a New Car

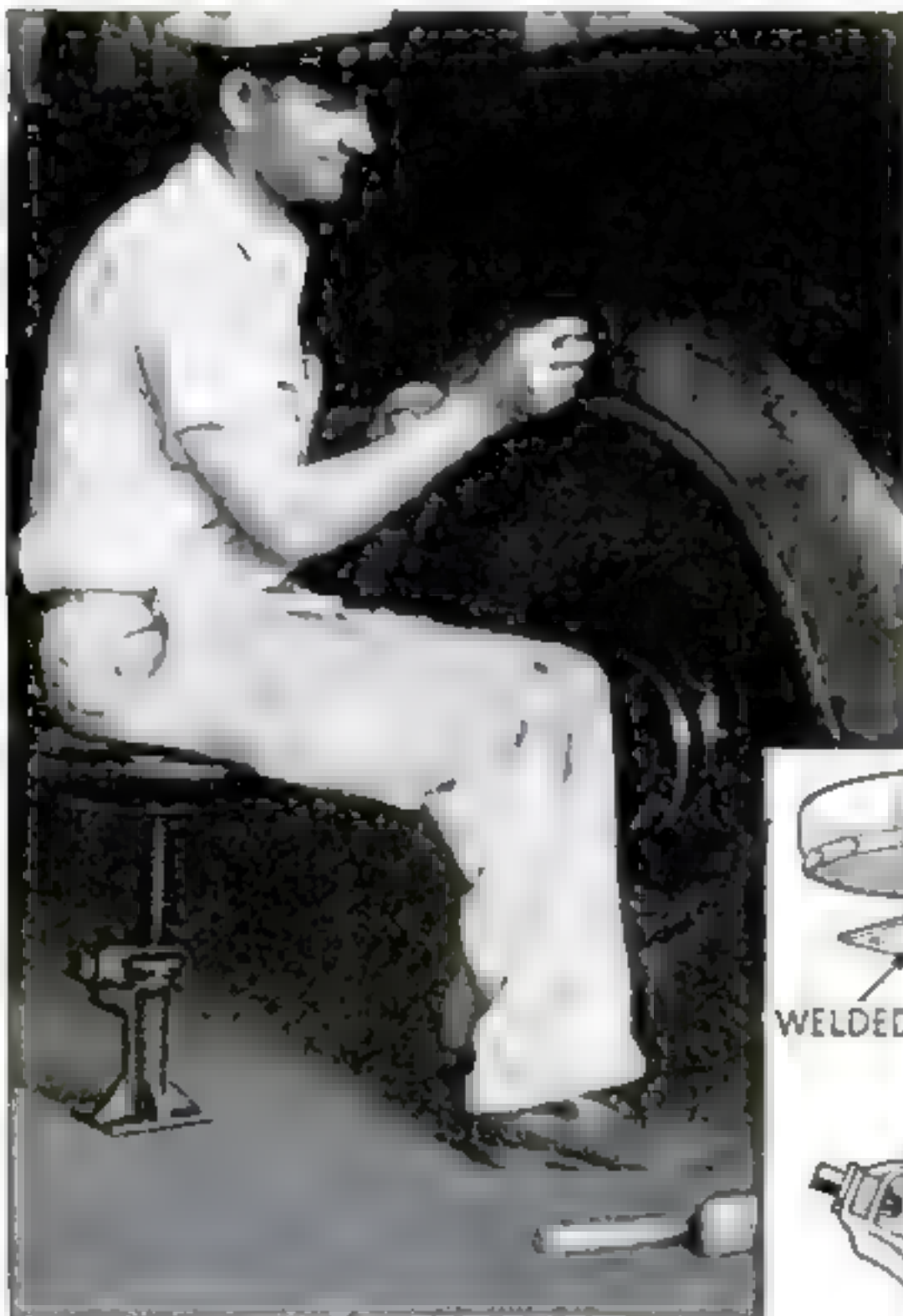
How can I grease my car, which has new-style hydraulic fittings, with a grease gun made for the old-style fitting? That problem stumped me until I tried putting an old-style fitting on the end of the gun and then using it in the normal way. The bottom of the old fitting makes a perfect union over the top of the hydraulic fitting.—F.S.



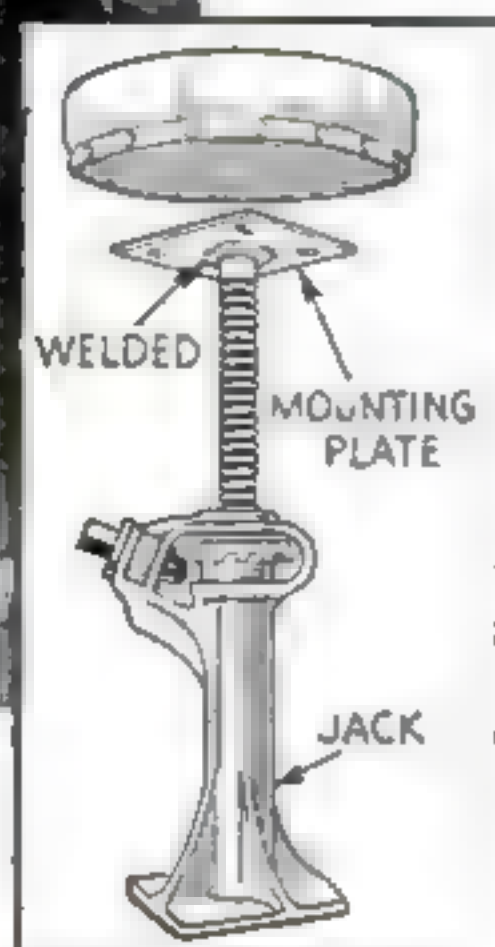
An old-type fitting is attached to the gun nozzle

Glove Is Case for Small Tools

THE SMALL tools that I keep in the dashboard compartment always rattled against each other until I hit on the idea of stowing them in the fingers of an old leather glove. The glove keeps them together, but prevents metal-to-metal contact.—H. J.



Adjustable for height, this homemade stool is handy for body and fender repair work



Jack Makes Adjustable Stool

FOR motorists doing body or fender repair work, a handy adjustable-height seat for use while working can be made from a junked screw-type auto jack. Make the seat by upholstering a wooden disk. Then weld a metal plate to the top of the jack and fasten it to the bottom of the disk with wood screws. A stool like that pictured at the left may be extended so that the seat is ten inches from the ground at its lowest position and twenty-three inches at its highest. Adjusted to the proper height for the work in hand, it gives added comfort and efficiency.—A.M.

Snap this tonight



With the new fast Kodak Super-XX Film, you can take just as good pictures indoors at night as you have taken outdoors in the sun

HOME'S the place to snap a baby when he's sweetest, a pup when he's cutest, the whole family when they're happiest. Use Kodak Super-XX—about four times as fast as ordinary film—and you can get the same clear, brilliant pictures indoors that you get outdoors. And

with any camera at all that takes Kodak Super-XX Film—even a \$1 Baby Brownie.

All you need besides camera and film are two or three Photoflood lamps in Kodak Handy Reflectors. (Photoflood lamps are inexpensive, and they last long enough for you to take dozens of snapshots.) A helpful booklet (illustrated) not only gives you the few simple directions you'll need, but suggests picture opportunities, and contains much useful information. It's **FREE** at your dealer's . . . Eastman Kodak Company, Rochester, N. Y.

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YOU
NEED . . .**



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Home craftsmen praise this light, penetrating oil. It's non-gumming—fine for electrical appliances, sewing and washing machines, bicycles, toys. Use it in your car generator. Free wall clip with every can.



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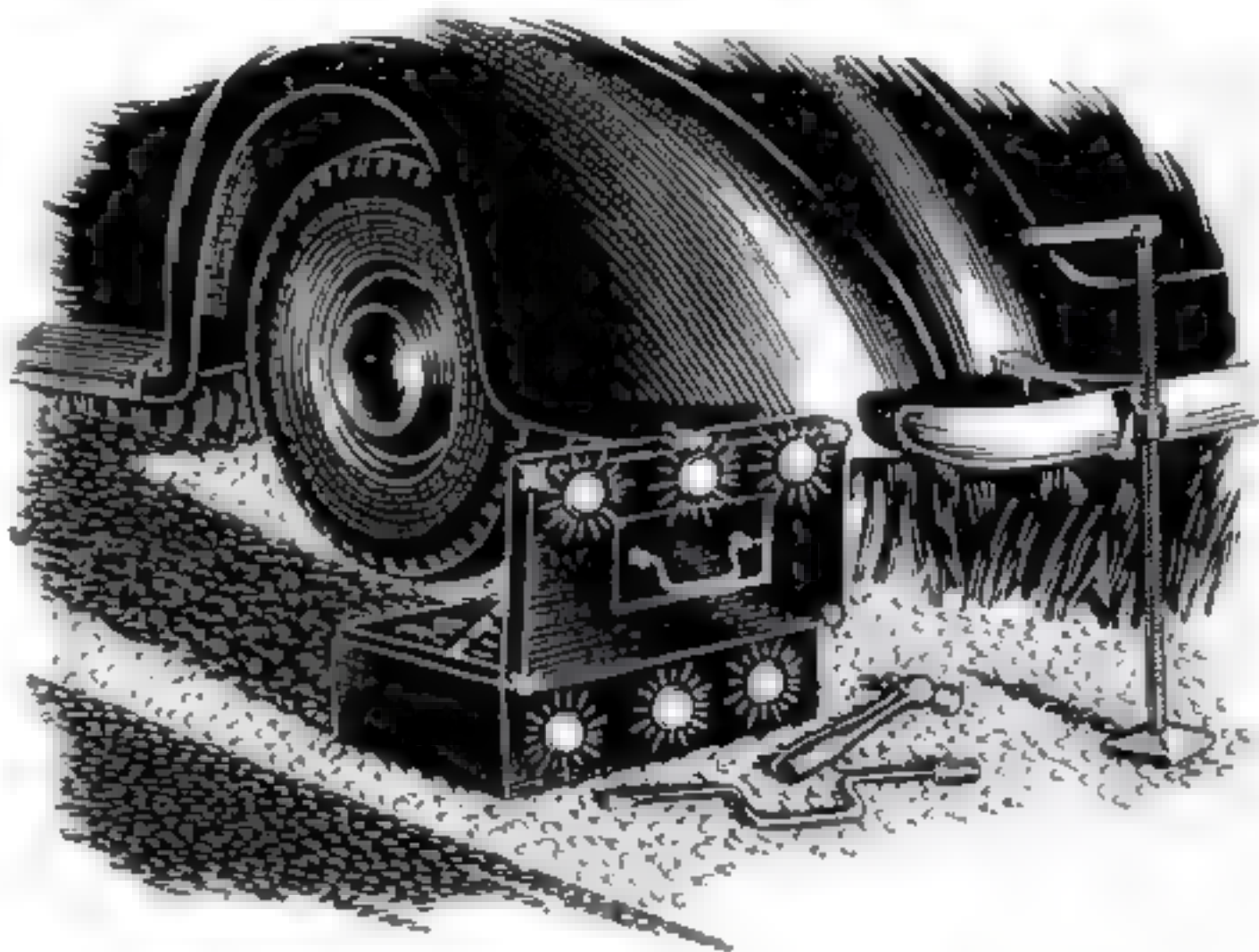
MOBILGLOSS • MOBILWAX • MOBIL STOP-LEAK
MOBIL HANDY OIL • MOBIL RADIATOR FLUSH
MOBIL WINDOW SPRAY • MOBIL UPPERLUBE
MOBIL HYDROTONE • MOBIL SPOT REMOVER



BY THE MAKERS OF MOBILOIL

Reflectors on Tool Box Give Safety at Night

WHILE changing a tire on an unlighted road some dark night, you can be sure that approaching motorists are warned of your presence by fitting out your tool box with a few red-glass reflector buttons of the type used for road markers and bicycle "tail lights." Fasten a row of them on the side of the box, and another row on the top, as shown below.—J.M.



Safety buttons reflect lights of approaching cars

Paint on Clock's Hands Makes It Easy to Read

BECAUSE of reflections from its convex glass front and its shiny chromium face, the dashboard clock on my car was often difficult to read without taking my eyes off the road for too long a time. To overcome this, I painted the tips of the hands a brilliant red.—F.A.



Painting arrow-type clock hands a brilliant red

as **POWERFUL** as it looks



The new **DELCO**

Take a look at this big new Delco battery, and know that from case to plates it is the powerhouse it looks! It teems with extra power to give you fast, positive starting, winter and summer—extra capacity to meet the demands of lights, radio and accessories—extra stamina to assure the satisfactory performance of all elec-

trical equipment. In materials and workmanship, it is the finest battery that Delco-Remy has ever built . . . in dependability and long life, it's as fine a battery as you can buy. You owe yourself the assurance of driving *security* that this powerful new Delco battery provides! Your dealer has one to fit your make of car . . . ask to see it.

*Replace with a
Delco battery*

Delco-Remy

MANUFACTURER OF DELCO-REMY
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SLAXON HORNS • DELCO BATTERIES
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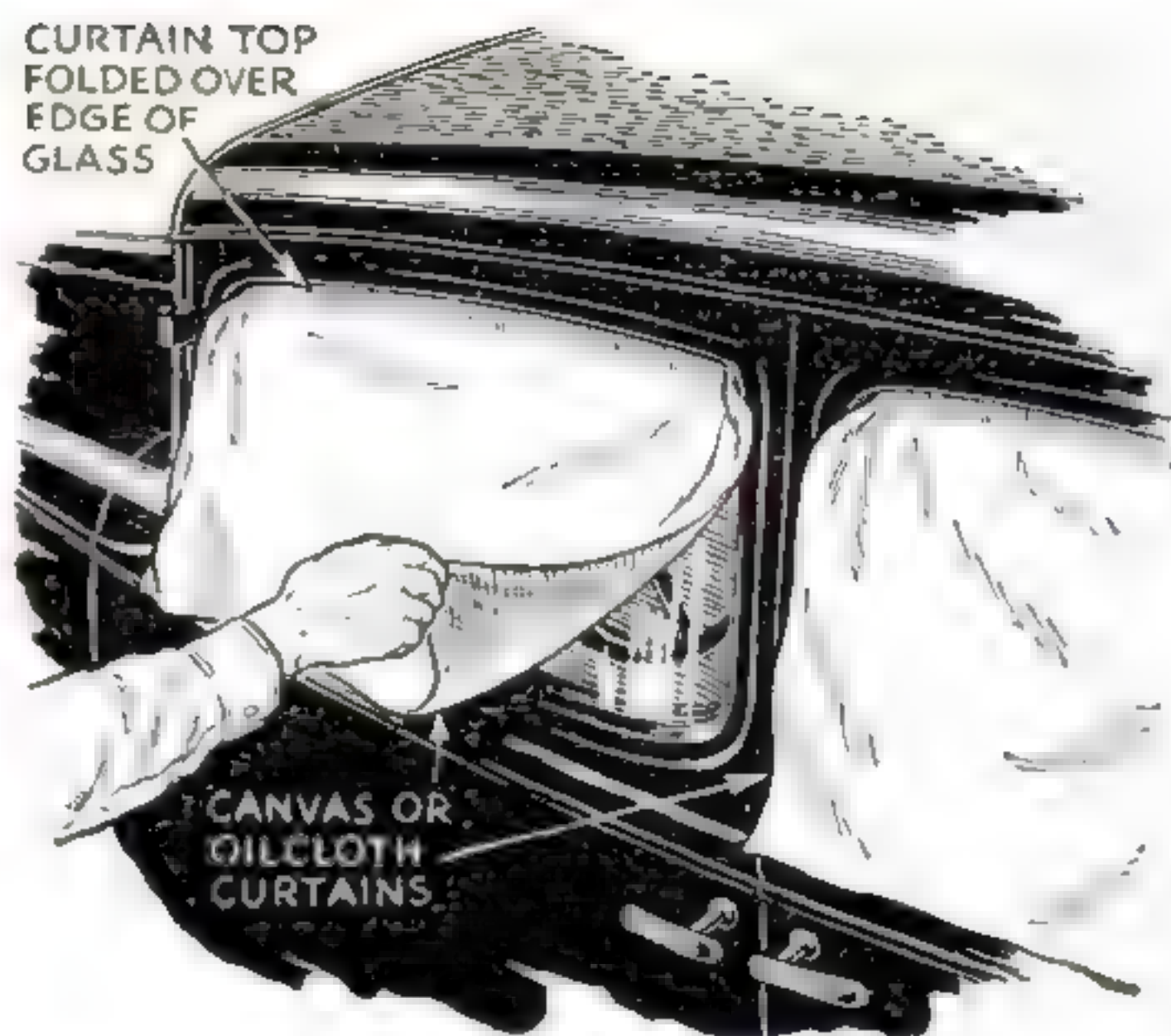
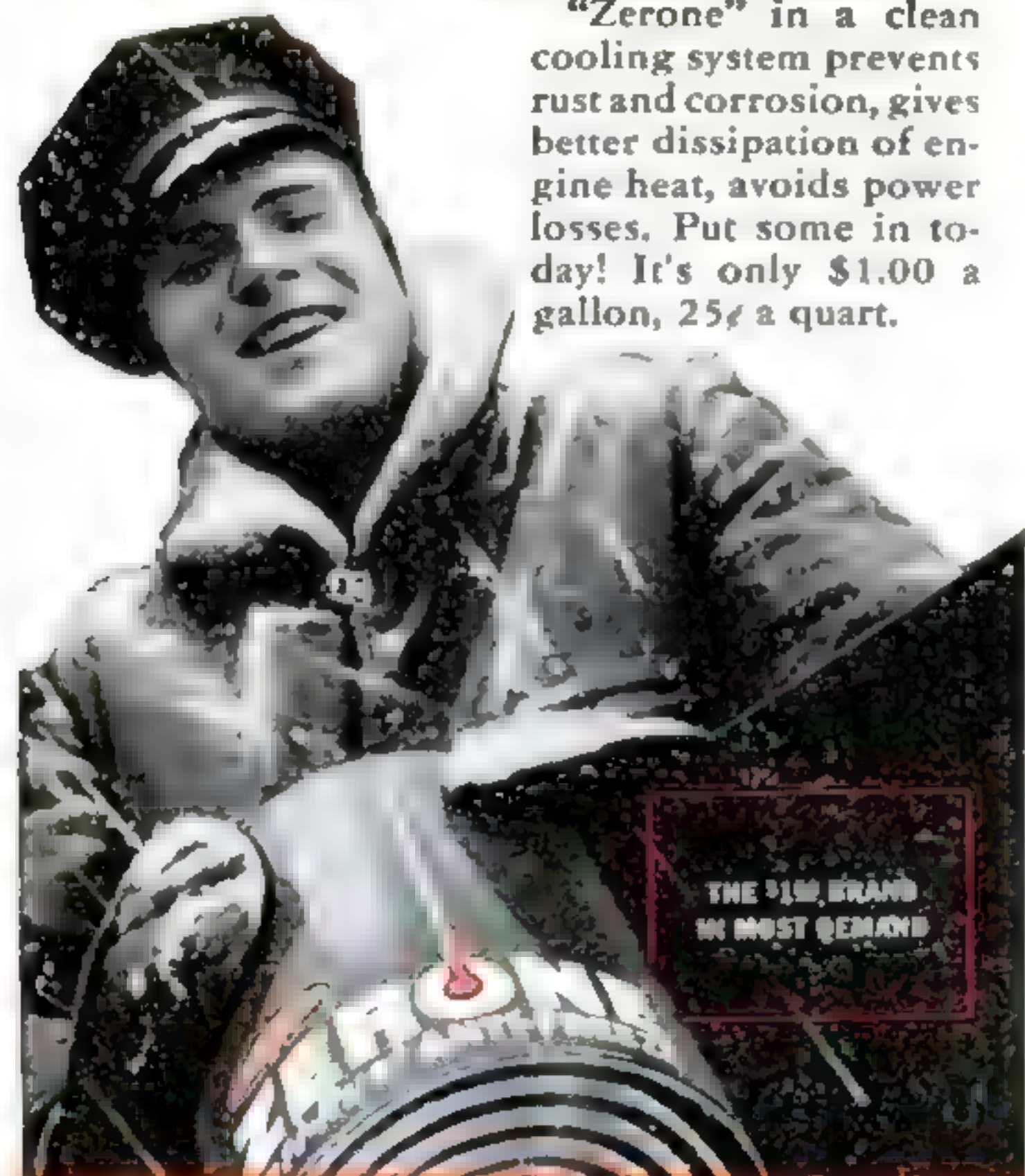


HERE'S the way many car owners do it every year! They put in a couple of quarts of Du Pont "Zerone" early in the season for protection against rusting and sudden cold snaps.

When winter gets down to business, they add enough "Zerone" anti-rust anti-freeze to protect to lower temperatures. A total of 6 quarts, put in as needed, can protect a car with an average size cooling system (15 quarts) for the entire winter. And 6 quarts of "Zerone" cost only \$1.50!

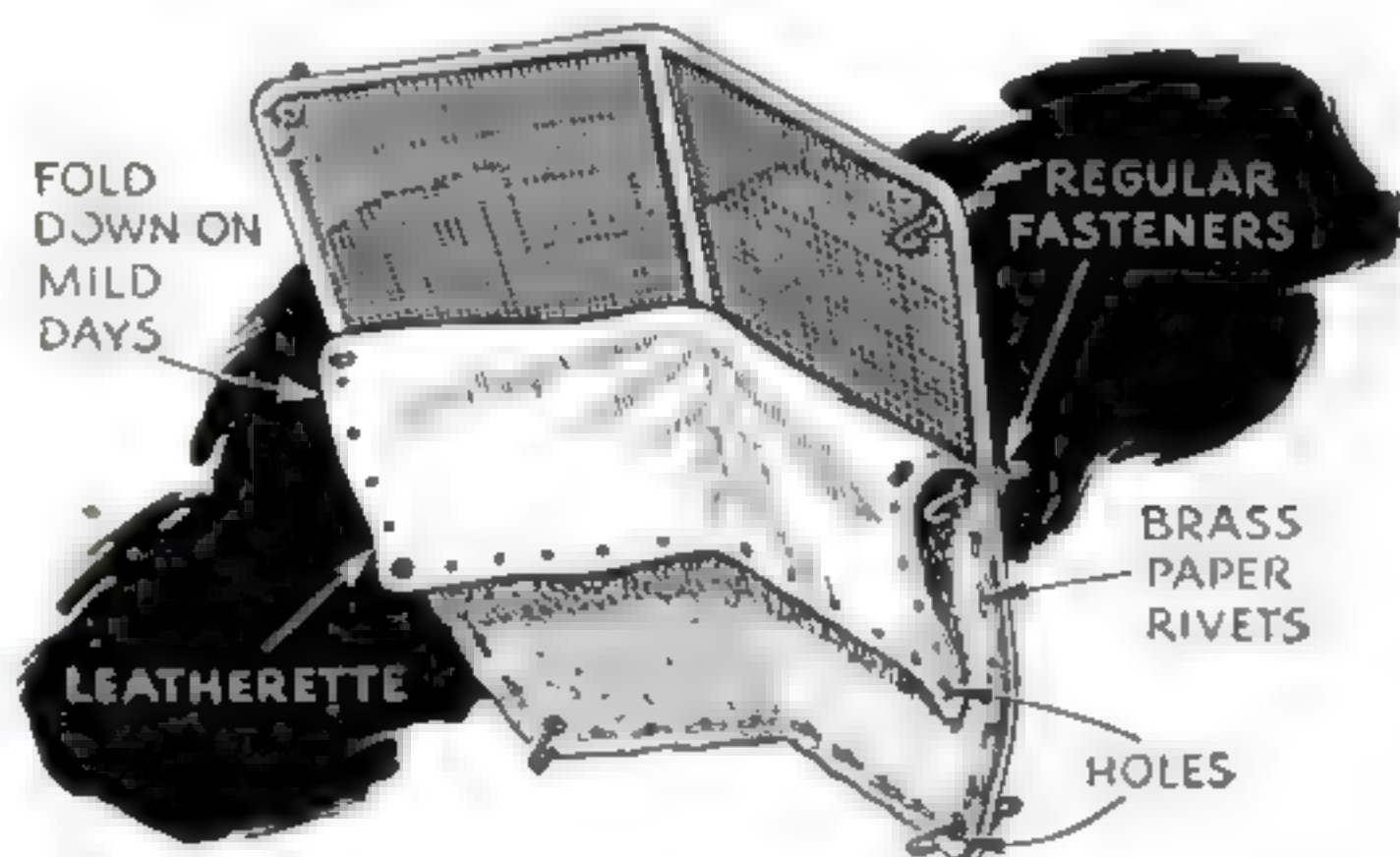
You may need a little more or less, depending on the condition and capacity of your car radiator and the severity of winter in your neighborhood. But you can be sure that the unusual efficiency of Du Pont "Zerone" will save you real money.

"Zerone" in a clean cooling system prevents rust and corrosion, gives better dissipation of engine heat, avoids power losses. Put some in today! It's only \$1.00 a gallon, 25¢ a quart.



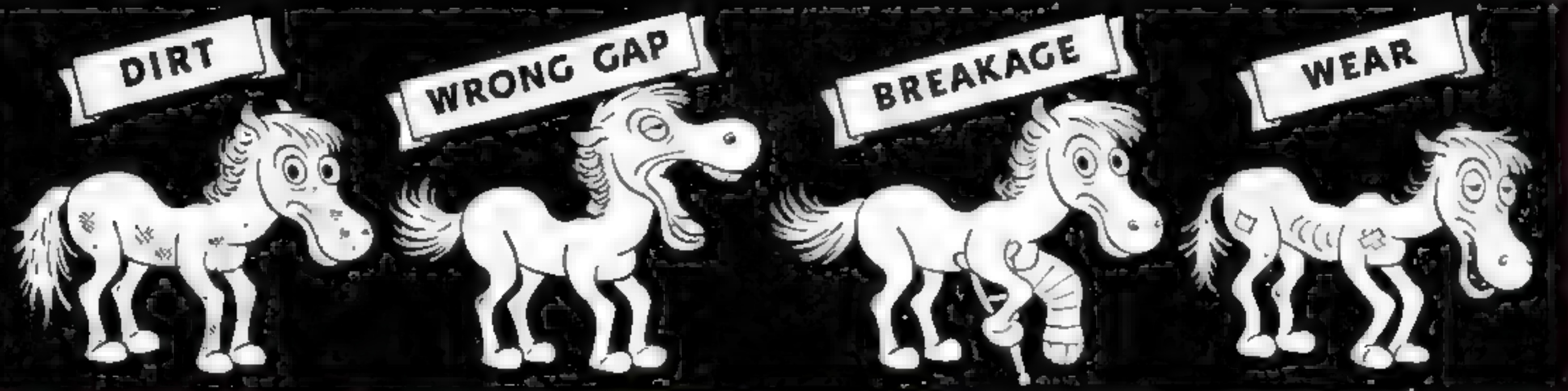
Curtains Cover Windows When Car Is Washed

IN ORDER to prevent water from running down inside the doors when an automobile is being washed, I have found that it is a good idea to fasten pieces of oilcloth or canvas over the windows, as illustrated above. The strips are held in place by being pinched between the top of the frame and the top of the window. Cut the pieces slightly larger than the window so that the edges will overlap.—C.H.



Radiator Winter Front Made from Bug Screen

A FEW simple changes will transform a radiator bug screen into a winter front for cold-weather use. Cut out a piece of leatherette to the exact outline of the screen, and then join the two with paper rivets or other fasteners, with the screen facing out. Cut holes in the lining to allow for the regular screen fasteners to extend through. The lining may be folded down part way if it is desirable to leave the radiator grille partially open.—A.C.N.



ONLY 4 THINGS CAN HAPPEN TO ANY SPARK PLUG

**and the Cure for Most Troubles
Costs only 5c a plug**

DIRT is the most common cause of spark plug trouble.



If the deposit is black, it's carbon or soot. If it is red, white, fused, or blistered, it's oxide—a residue of combustion.

THE CURE is a thorough cleaning (5c a plug) in the special machine developed by AC engineers. You will find this machine in service at more than 70,000 Registered AC Cleaning Stations. You can identify them by this sign. →



WEAR is next in frequency. It is reasonable to expect about 10,000 miles of service from any standard make of plug. (Cleaning and adjusting are needed, of course, at 4,000-mile intervals.)



THE CURE is a new plug, or a set of new plugs. And you can't go wrong if those new plugs are AC Quality Spark Plugs.

WRONG GAP is related to wear.



Wear causes this condition. Sometimes, although rarely, gaps widen too quickly. This indicates that the plug in use cools too slowly, or is of the wrong type.

THE CURE for normal wear is gap adjustment with the special AC tools with which Registered AC Cleaning Stations are equipped. Accuracy is assured by a special gauge which conforms to the arc of the worn gap. Adjusting is a regular part of the AC Cleaning Service. The cure for abnormal wear is a new plug of correct type and temperature range. Better make it an AC.

BREAKAGE is the fourth trouble.

A broken upper insulator is always the result of a blow, as when a wrench slips. A broken lower porcelain results from attempting gap adjustment by bending the center electrode; or from use of a plug which cools too slowly or is of the wrong type.

Breakage is very rare.

THE CURE is a new plug.

May We Point Out—

A visit every 4,000 miles to your Registered AC Plug Cleaning Station will keep your plugs in good condition. Dirt will be removed before it can cause serious gas waste, power loss, and starting trouble. Gaps will be kept in adjustment. Wear will be eliminated when it becomes pronounced. Breakage will be remedied.

Plug cleaning is a splendid 5c habit. It will pay for itself many times over.





THE SAW OF AMAZING VALUE

Amazing values in circular saws for your home workshop—KEYSTONE made by DISSTON! True running, long-lived. They fit your machine, suit your work. Designed for fine craftsmanship at low cost. Ask your dealer for Keystone Home Workshop Circular Saws—Made by Disston.

Cross-cut; Combination
6" ($\frac{1}{2}$ " hole) . . . \$1.70
7" ($\frac{1}{2}$ " hole) . . . 1.80
8" ($\frac{1}{2}$ ", $\frac{5}{8}$ ", $\frac{3}{4}$ " hole) 2.00
10" ($\frac{5}{8}$ ", $\frac{3}{4}$ " hole) 2.40
(Rip saws slightly lower)
Also Hollow Ground,
\$3.00 to \$5.00

These prices apply only to United States; for others, write Henry Disston & Sons, Ltd., Toronto, Canada

and the Hint of the Month

Trimming inlay picture with "square board" made of $\frac{5}{32}$ " plywood, with a strip to fit table slot clinch-tacked to bottom, and with cross pieces squared to saw.



New edition—FREE BOOK



SEND COUPON!

Completely revised Disston Saw, Tool and File Manual. 48 pages, contains a number of hints like the one above. Tells how to choose saws; to joint, set and sharpen saws; and uses of other kinds of tools. Many illustrations.

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Tested Shop Plans for Making Gifts

CHRISTMAS is less than three months away, so now is the time to start planning those gifts you intend to make yourself. To assist you, POPULAR SCIENCE MONTHLY offers a wide variety of projects, including attractive pieces of furniture, beautiful ship models, toys, radio sets, and miscellaneous items. A complete blueprint list will be sent free upon receipt of a stamped, self-addressed envelope.

A few of our more popular projects—some simple, some elaborate—are listed below. All of them have been illustrated in the magazine and for the benefit of readers who would like to look up those pictures, a reference to the date and page of issue is given in parentheses after each item.

FURNITURE

Early American End Table (Dec. '38, p. 180), 361A	.25
Filing Case, table height of 30" (Feb. '39, p. 172), 365A	.25
Magazine Rack and Wastebasket to Match (Dec. '36, p. 75), 296A	.25
Maple Tavern or Long Table, colonial; top is 30" by 68" (May '37, p. 80), 318A	.50
Modern Tea Wagon and Cabinet into Which It Rolls (Apr. '37, p. 83), 313A	.25
Queen Anne Dressing Table, Stool, and Mirror (Dec. '36, p. 74), 295A	.75
Six-Footed Coffee Table, 14" high; top is 14" by 26" (Sept. '37, p. 103), 327A	.25
Small Early Colonial Pine Chest, 32" long, 21" deep, 24" high (Mar. '37, p. 87), 308A	.25
Softwood Coffee Table (Nov. '37, p. 97), 332A	.25
Special Bookcase for holding forty-eight issues of Popular Science Monthly (Oct. '38, p. 216), 353A	.25

MODELS

Barneget Lighthouse, 10 $\frac{1}{2}$ " high (Oct. '36, p. 69), 298A	.25
Clipper Ship GREAT REPUBLIC, 31 $\frac{1}{2}$ " hull (Dec. '35, p. 59), 272-273-274-R	1.25
Clipper Ship SEA WITCH, 9 $\frac{1}{2}$ " hull (Dec. '33, p. 66), 219	.25
Coast Guard Patrol Boat of 165' Type, 20 $\frac{1}{2}$ " hull (July '36, p. 55), 286-287-R	.75

(Continued on page 230)



WHEN A
MISS MAKES
A HIT
...why don't YOU
give him

Velvet
*Better
smoking
tobacco*



—for **MILDNESS**
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Kentucky Burley
aged in wood

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of pure maple
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good taste

*Velvet packs easy in a pipe
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for both*

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Please send me the new 1939 52-page, full-color Lionel Catalog. Enclosed is 10c (for postage and handling).
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Blueprints for Gifts

(Continued from page 228)

Confederate Raider ALABAMA, 21½" hull (Feb. '38, p. 77), 335-336-337-R.....	1.5
Elizabethan Galleon REVENGE, 21" hull (Apr. '33, p. 65), 206-207-208-209	1.0
Farragut's Flagship HARTFORD, 33½" hull (Jan. '34, p. 57), 221-222-R.....	1.5
Fishing Schooner WE'RE HERE of "Captains Courageous," 7½" hull (Oct. '38, p. 172), 351-R .....	.5
Harbor Tugboat and Barge, miniature water-line models 5 3/16" and 7 3/16" long respectively (June '36, p. 74), 255.....	.2
H.M.S. BOUNTY, 8½" hull (Apr. '35, p. 68), 254 .....	.2
Liner NORMANDIE, 20½" hull (Oct. '35, p. 57, 264-265 .....	.5
Liner QUEEN MARY, 10½" hull (May '36, p. 74), 283 .....	.2
Liner PRESIDENT LINCOLN, 14½" long (Aug. '37, p. 88), 325.....	.2
Locomotive, Hudson type, HO gauge, 14" long, driven by 6-volt motor (Nov. '37, p. 89), 329-330-R .....	.7
New Bedford Whaleboat, with complete equipment, 14" hull (Sept. '37, p. 104), 326-R.....	.5
Ocean Freighter, 14" hull (Oct. '35, p. 57), 271.....	.2
Old Naval Cannon, a six-pounder in battery, period about 1798; gun is 7½" long, model over all is 9" by 11½" (Nov. '38, p. 170), 352 .....	.2
Privateer SWALLOW, a Baltimore clipper, 13" hull (Nov. '34, p. 65), 228-229-230-R.....	1.0
Revenue Marine Cutter of 1850 JOE LANE, 21" over all (Nov. '39, p. 174), 374.....	.7
Trading Schooner, three-masted, 17½" hull (Mar. '35, p. 68), 252-253.....	.5
Yacht NOURMAHAL, 8½" hull (Jan. '36, p. 61), 276 .....	.2

BOATS

Cabin Cruiser, 17' long, weighs 750 lb., for use with inboard or outboard motor from 2 to 10 h.p. (Feb. '39, p. 161), 356-357-358-359-R.....	1.5
Fisherman's Outboard Boat, 9' 3" or 11' 6" long, weighs 115 or 160 lb., for motors from 3 to 16 h.p.; can also be rowed (July '38, p. 55), 344-345-R .....	.7
Racing Runabout, 13' stepless hydroplane for outboard motor, weighs 275 lb. (June '35, p. 60), 261-262-R .....	.7
Racing Sailboat BLACKCAT, 13' 4" long, weighs 250 lb., Marconi rigged (July '37, p. 71), 321-322-323-R	1.0
Sport Runabout, 9' 8" long, weighs 100 lb., for small outboard motors (Apr. '37, p. 71), 309-310-R .....	.7
Utility Rowboat, 13' long, weighs 175 lb.; can also be sailed or driven by outboard motor (Aug. '34, p. 84), 224-R.....	.5

MISCELLANEOUS

Bed or Armchair Table (Dec. '37, p. 85), 333A.....	.2
Beginner's Battery Radio (Feb. '39, p. 223), 365A .....	.2
Bicycle Trailer (Apr. '39, p. 161), 367A.....	.2
Cigarette Holder, designed in form of miniature three-gun naval turret (Feb. '37, p. 91), 299A .....	.2
Mexican Patio Furniture for Dolls—covered-wagon couch, roll-around couch, table, and cart (Dec. '38, p. 164), 354A-355A .....	.7
Photographic Split-Image Range Finder (June '39, p. 168), 369A .....	.2
Rowboat Back Rest (July '38, p. 73), 347A2
Turned and Inlaid Bowl and Candlesticks (Feb. '37, p. 79), 307A.....	.2

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Willard's New Safety-Fill protects you against "blindfold filling"

• Whenever a service man can't *see* the level of the battery solution he may accidentally over-fill your battery. Such "blindfold filling" results in dangerous corrosion because the excess electrolyte surges up through the vents in the top of the battery and attacks the wiring and exposed metal parts of the car.

Now Willard's famous "H-R" battery is built with a new and unique construction (*called Safety-Fill*) that gives positive protection against this dangerous over-filling and the corrosion that is bound to follow.

Built to last 68% longer than the average of 100 other brands—having "power-house" performance with tremendous reserve capacity—and now equipped with "Safety-Fill"—the "H-R" is the battery "buy" of the year. Have your Willard Dealer show you this exclusive new battery that simply *can't* drink too much.

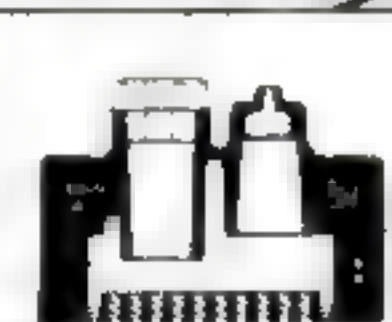
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VENT**
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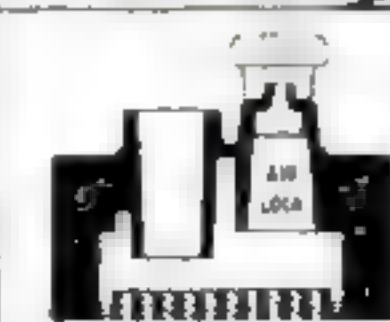
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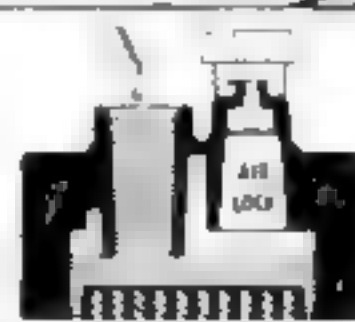
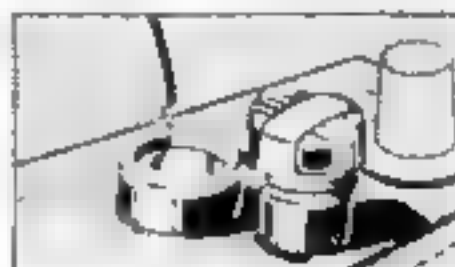
HOW WILLARD SAFETY-FILL WORKS



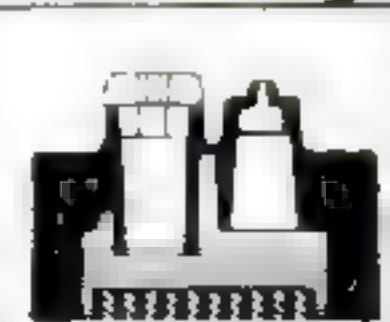
To fill the battery, unscrew filler-cap as usual.



Place cap on SAFETY-VENT, forming air lock in breather-chamber.



Fill well with water. Air lock prevents solution rising above bottom of well.



Remove cap from SAFETY-VENT and solution drops to correct level.

It never drinks too much!

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...on furniture, cabinets, boats, etc.... use Casco Powdered Casein Glue. Easy to mix. Used cold. Resists moisture, heat and rough usage. 10c to 65c at Hardware, Paint and Lumber Dealers.

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Precision-Shaped Hull Contained in Kit for "Joe Lane" Model

COMpletely shaped and routed out to the correct deck levels, the hull in our construction kit (No. 11S) for making a model of the *Joe Lane* needs little to be done to it except the sanding. This makes it possible for anyone to complete the model with only a few simple tools.

The *Joe Lane* was one of the first ships constructed for the Revenue Marine, forerunner of the U. S. Coast Guard, and was rated as a topsail schooner. When built to a scale of $\frac{1}{8}$ " equals 1', the vessel makes an attractive model 21" long and 13" high.

Our construction kit, shown above, contains, in addition to the hull, all the necessary raw materials for masts, spars, deck

(Continued on page 234)



Model of destroyer "Preston" built with Kit 2S

FAMOUS

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Handyman

HOME . . . HOBBYIST TOOLS

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IT RATCHETS

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Set, 39c

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Insert "Yankee" Chuck-and-Drill in place of blade. You then are ready to bore small holes.

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WORLD'S LARGEST MANUFACTURERS
of Model Airplanes, Ships and HO-Gauge Railroads

New Construction Kit

(Continued from page 232)



Kit V is for making
this clipper model

fittings, and rigging, and the following finished parts: blocks, bullseyes, deadeyes, belaying pins, capstan, steering wheel, paddle eyes, anchors, and hawse lips. Full size drawings are, of course, included. The price is only \$7.00 (25 cents additional west of the Mississippi River and in Canada).

Many other decorative ship models can be made with our kits. For those wanting elaborate clipper ships, there are the *Sovereign of the Seas* (Kit V, \$4.95†) and the *Great Republic* (Kit 4S, \$8.40*). The first is 26" long over all and the latter is 42" long. Admirers of war vessels will like the battleship *U. S. S. Texas* (Kit E, \$7.45*) and the *U. S. Navy destroyer Preston* (Kit 2S, \$5.95*). The battleship is 3' long and the destroyer is 31½" long.

A complete list of our kits appeared on page 216 of the October issue. An illustrated leaflet describing the kits will be sent free upon receipt of a large, self-addressed, and stamped envelope.

Note: If you live west of the Mississippi River or in Canada, add 50 cents to prices marked with an asterisk (*) and 25 cents to prices marked with a dagger (†).

Popular Science Monthly, Dept. 119A
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Please send me C. O. D. Kit.....

I will pay the postman the price shown above plus a few cents postage in full payment. (Canadian orders cannot be sent C. O. D.).

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If you prefer to send your remittance with this order, you save the C.O.D. charge. Remit by money order, check, or registered mail. This offer is made only in the United States and Canada. Also see note above.

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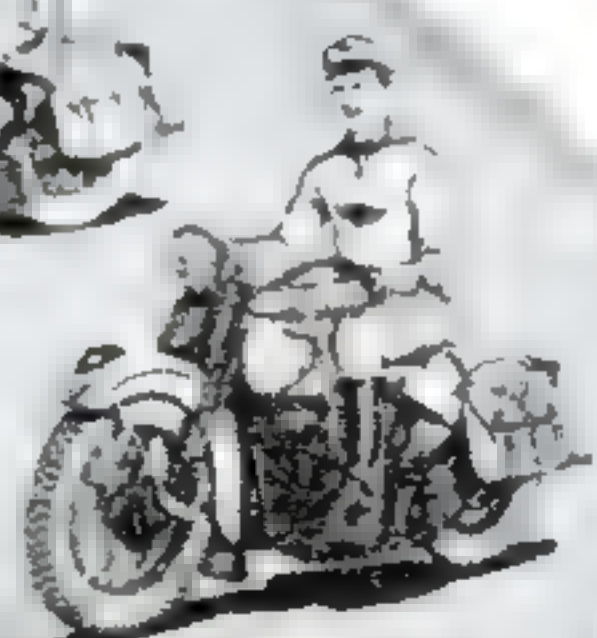
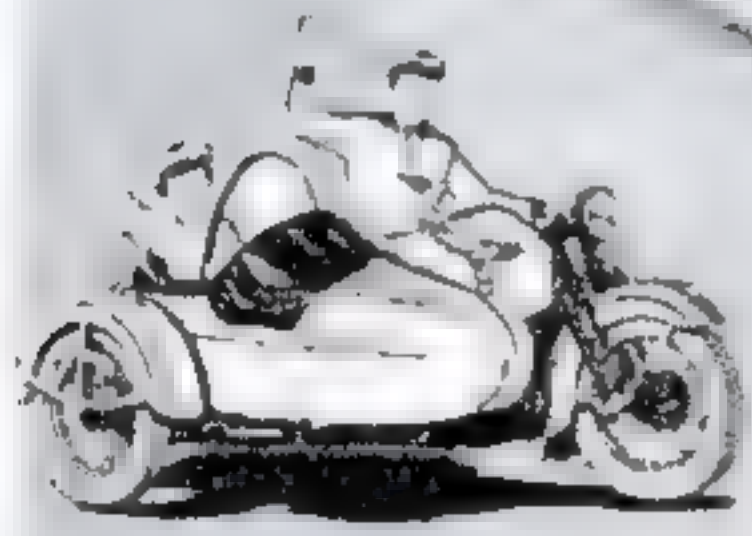
Sensational beauty! . . . Rugged dependability! Zooming power to whiz you along the highways with other thrill-loving riders. There's always something doing — exciting events — gypsy tours, tourist trophy races, hillclimbs, rallies — yes, and new distant places to reach quickly and economically — to see and explore.

See your Harley-Davidson dealer today! Learn why two out of every three motorcycles on the road are Harley-Davidsons. See the 1940 models with their smart, streamlined styling — appealing new color scheme — beautiful color options — lower prices.

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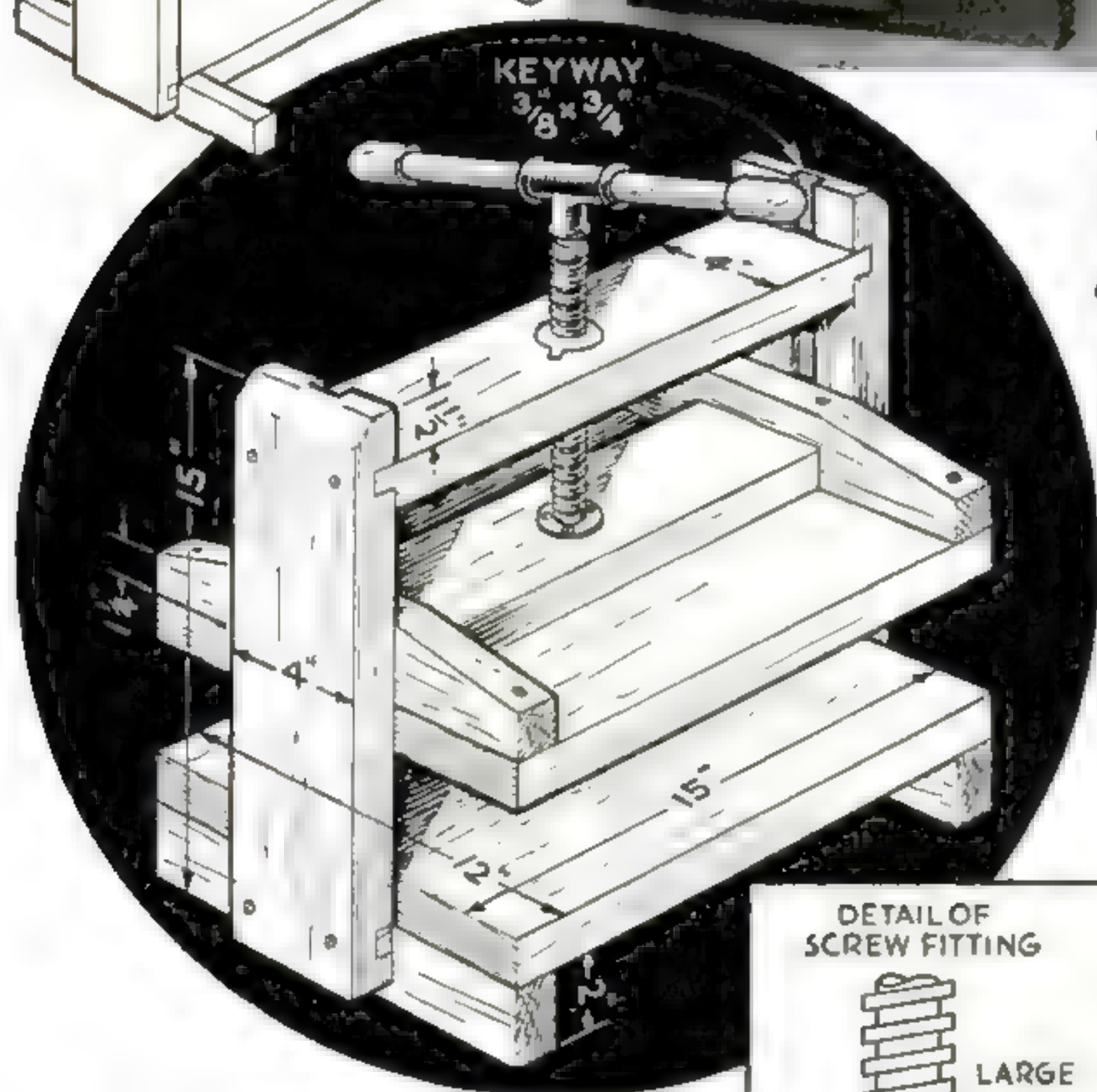
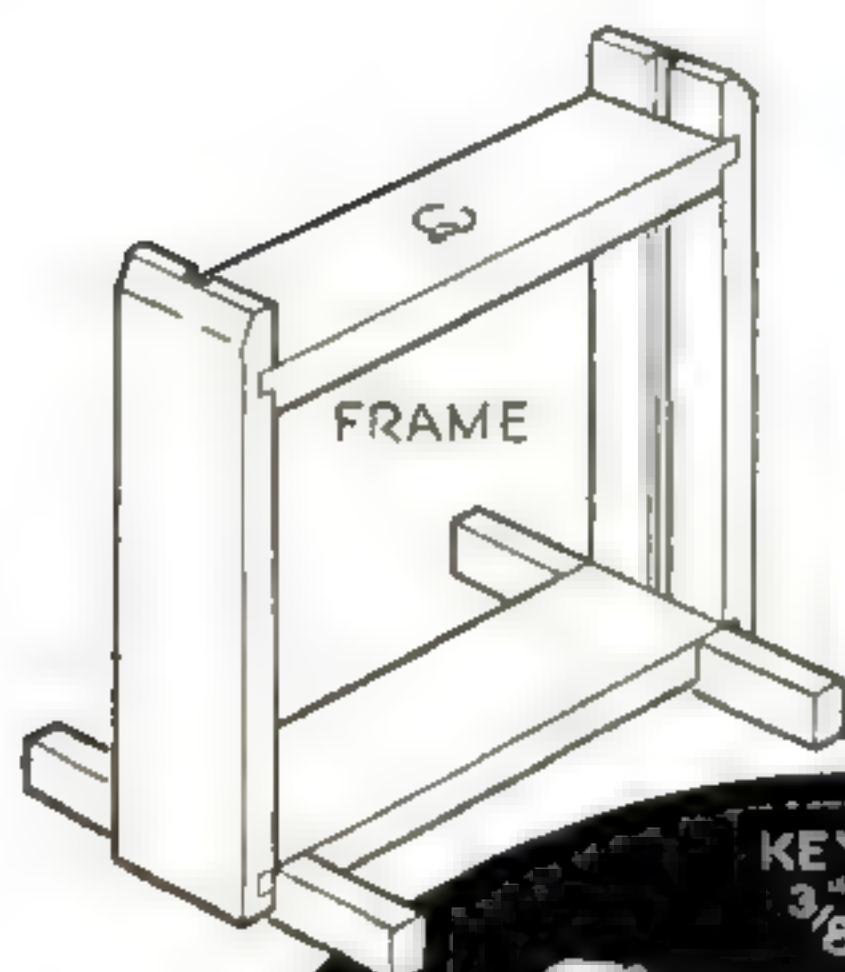
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Address.....

Curled prints are slightly moistened on the back, placed between blotters, and put under pressure in the press as at the right



Construction of press. At right, one end of bench screw is filed so a washer may be slipped on



Photographic PRESS

BUILT BY USING
VISE SCREW

and two crosspieces at the ends. Small blocks are fastened to the ends of the upper platen to act as keys.

The threaded nut of the bench screw is fitted into the crossbar at the top of the frame by boring a hole, tapering the hole, and cutting a keyway. The end of the bench screw is filed down so that a large iron washer can be slipped on. The washer should have three countersunk holes drilled through it

previously, as shown. Attach the washer to the screw by drilling two holes through the end of the screw at right angles to each other and separated by the thickness of the washer. Steel pins driven through the holes will hold the washer on the screw, yet permit it to rotate freely. Fasten the washer to the cross brace on the top of the upper platen with three flathead wood screws. Finish the press by applying a suitable wood stain and then varnishing.

The curled prints are slightly moistened on the back, placed between blotters, and put under pressure between the platens of the press.—FRANK MCCARTY.

HEAVERY iron presses for flattening photographic prints are expensive, but a substantial wooden press can be made at low cost. All the $1\frac{1}{4}$ " thick oak used for the press illustrated was salvaged from old furniture, and the only expense was less than a dollar for the carpenter's vise screw.

The joints and keyways in the two end pieces are cut on a circular saw. Large flat-head wood screws are used to assemble the frame. The bottom platen is made up of several pieces and attached to the frame with screws from underneath. The upper platen is also made up of several pieces, which are held together by a wood brace down the middle

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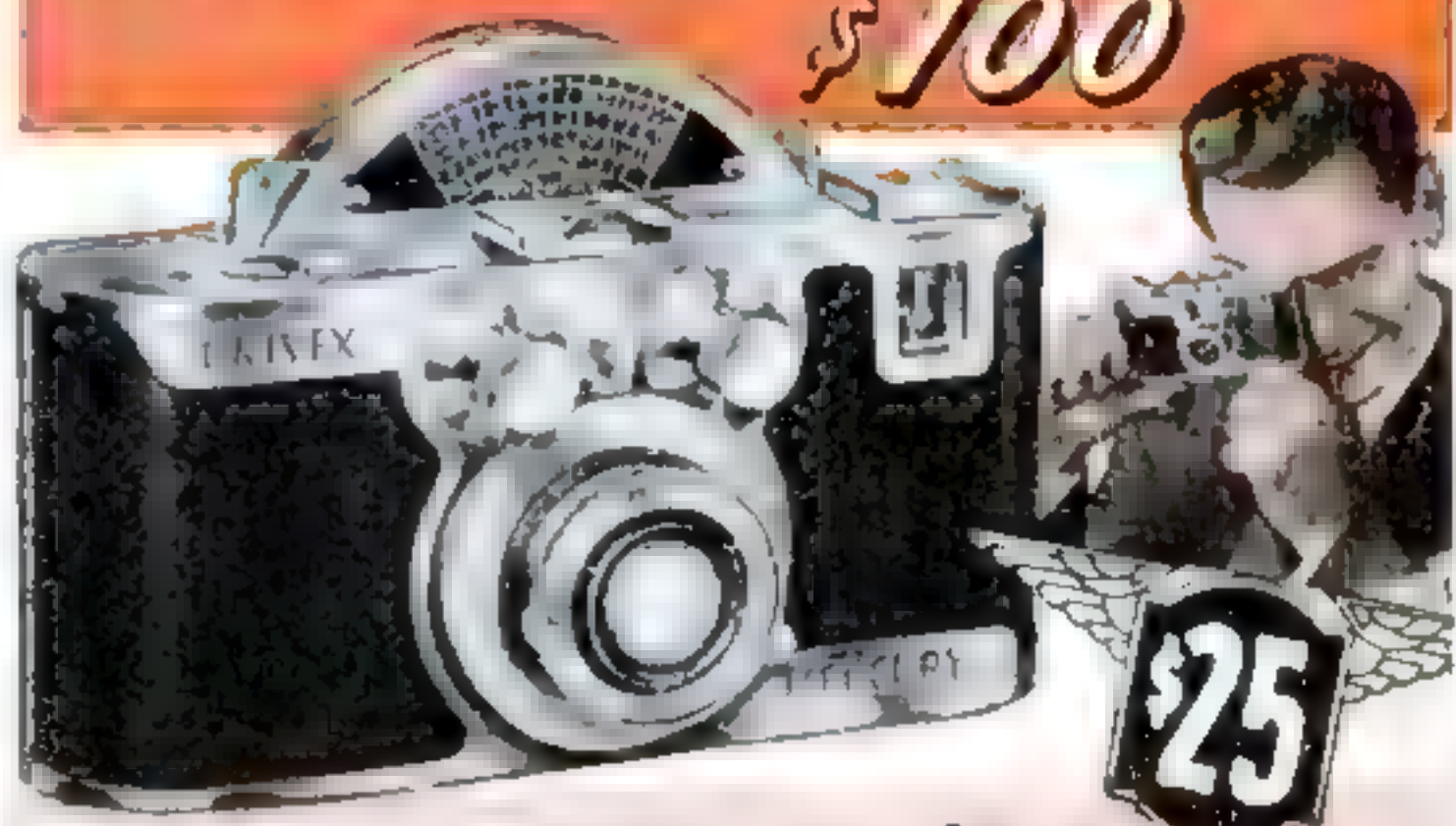
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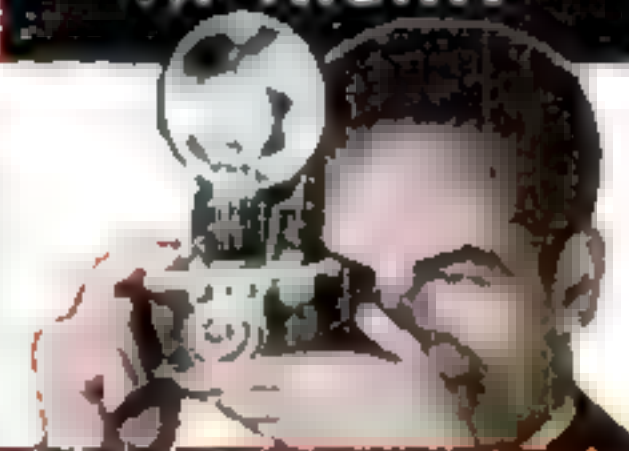
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Cloth Strainer on Faucet Protects Photographs



A SMALL cloth sack attached to a faucet as illustrated will strain rust and other particles from water to be used in preparing photographic solutions or washing negatives and prints. It also reduces splashing. Any close-woven cloth through which water will flow may be used. Hem a rubber band around the open end to hold it on the faucet.—W. E. B.

Acid Stop Bath Tested with Litmus Paper

IN PROCESSING prints, many photographers use an acid short-stop bath, but this loses its efficiency after a number of prints have been dipped in it without giving any indication of its diminished strength. A test may easily be made, however, by inserting a strip of blue litmus paper. If the paper turns red, the bath is still fit to use. As the bath loses its efficiency, the litmus paper will turn lighter shades of red until finally there is no change in the paper at all. A fresh short-stop bath should be prepared long before this happens.—E. S.

Chamois Case Protects Set of Lens Filters

CAMERA filters may be protected and kept free from dust and scratches in a case made by folding and stitching a piece of chamois skin as shown. Before a filter is removed for use, any lint that may have collected on it can be removed by giving it a slight rub between the fingers while still in the case.—SIDNEY R. BAYNE.

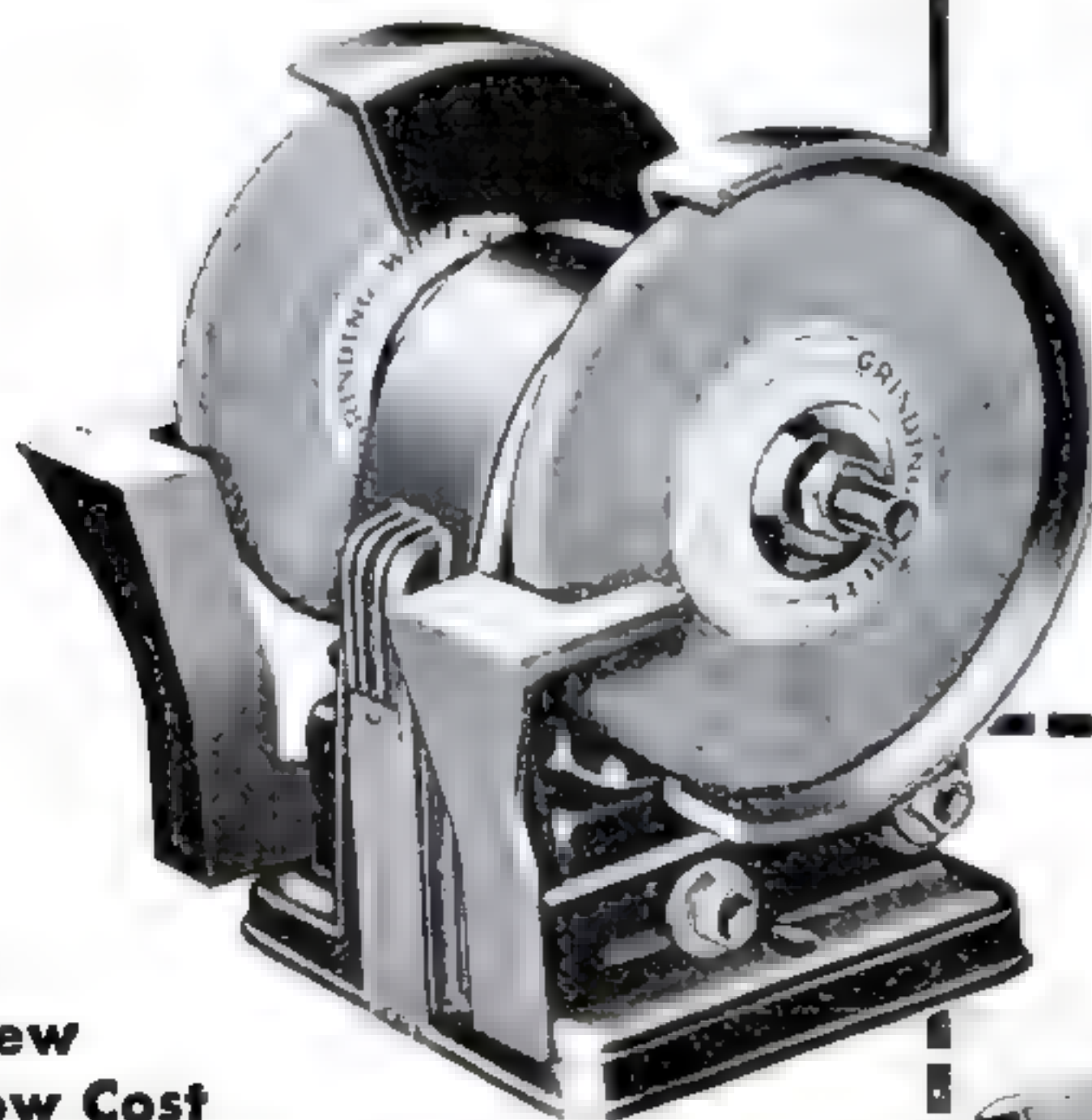


New Delta Shaper

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Once again Delta announces a big step forward in power tool design—a basically improved shaper built to the same high standards that characterize all Delta Machines. Here is a powerful, smooth-running, accurate tool that gives you heavier, faster cuts than the ordinary light shaper. It will shape, form or mould any form of work from the smallest mouldings to heavy production work.

Some of its new features are: 1. *Large Husky Spindle*; 2. *Exceptionally Big Table*; 3. *Long Spindle and Spindle Travel*; 4. *Large Sealed-for-Life Bearings*; 5. *Powerful V-Belt Drive*; 6. *Interchangeable Spindles*; 7. *Fully Adjustable Fence*; 8. *Strong, Welded Cabinet*. Every man interested in power tools should get the full details on this remarkable machine.



New Low Cost Delta Grinder and Buffing Head

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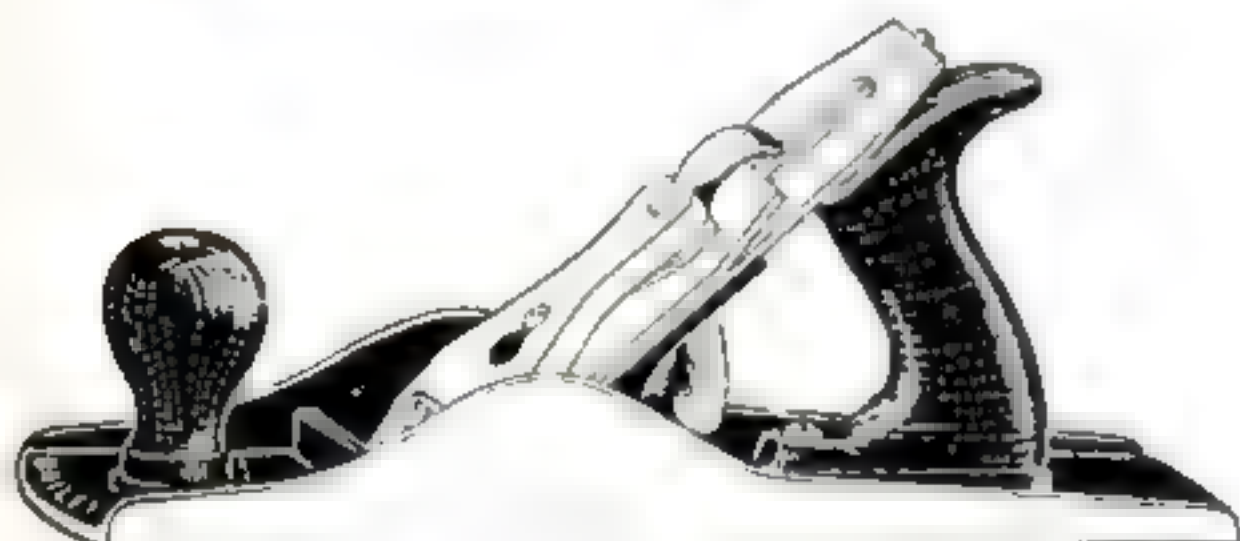
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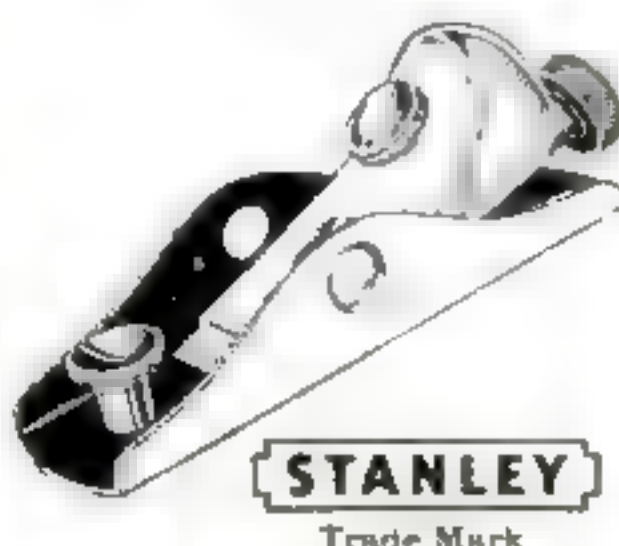
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Gus Solves A Stinger

(Continued from page 152)

she had started home, and then remembered that she had to go to her aunt's house, in the other direction; that she had tried to turn around and had stalled her engine, and that she couldn't get it started again.

"'Hop out, Miss,' I told her, 'and let me have a try at it.'"

"She got out and I got in. When I stepped on the starter the engine took off, but it ran in a weak, sputtering sort of way, and every time I put the car in gear and speeded up the engine to try to pull the rear wheels out of the ditch, it went dead on me. After I had tried four or five times the car was full of black smoke that had me coughing and made my eyes water, and some of the young fellows who were standing around were beginning to grin and wisecrack.

"I hated like the dickens to admit that I couldn't get that car started, but I was just about to give it up and ask some of the crowd to help me push it out of the road when that black smoke gave me an idea. When I got out and took a look at the rear end I was sure that I was right. The exhaust pipe was low-hung and it stuck out several inches beyond the back of the car, and it was right up against the outer bank of the ditch.

"I got some fellows to push the car until the rear wheels were part way out of the ditch, and blocked them with a couple of rocks. Then I took a look at the exhaust pipe, and knew that I had guessed right. When the rear wheels had rolled down into the ditch the end of the pipe had bitten into the bank and cut itself a nice, close-fitting plug of sticky clay. I suppose the gaskets were loose enough to allow enough of the exhaust to escape for the engine to idle weakly, but as soon as you gave her the gas the back pressure built up and killed it. As soon as I had cleaned out the exhaust pipe, it ran all right."

"Nice going, Jerry," put in Gus, approvingly. "You should have been a mechanic. . ."

"That reminds me—" interrupted Jack Simpson. But Gus Wilson was pointing an accusing forefinger at the shop clock.

"That clock reminds me," he said, "that it's a quarter past twelve! I don't want to seem inhospitable, gentlemen, but these lights are going out in exactly two minutes. And fifteen minutes after they go out I'm going to be home and in bed!"

"That's another of your bright ideas," George Knowles said, getting up and stretching.

"I'm chock-full of them!" Gus admitted.

Converting a Photo Tray into a Print Washer

PHOTOGRAPHIC prints may be washed efficiently in an ordinary developing tray if a sheet of glass is fastened to one edge, as shown. The glass, which should incline to the bottom of the tray at an angle of about 45 deg., may be held in place with two spring clothespins. Adjust the tray so that the water falls on the glass, thus setting up a current across the bottom.



Films should be washed in running water from fifteen to thirty minutes, depending upon the frequency with which the water is renewed in a tray or tank. Double-weight papers require to be washed in running water for one hour, or by transferring them twelve times from one tray of fresh water to another. Each time the prints should be left in the fresh water for five minutes. Single-weight papers require only one half that time.

Foolproof Way to Mount Film-Drying Clips



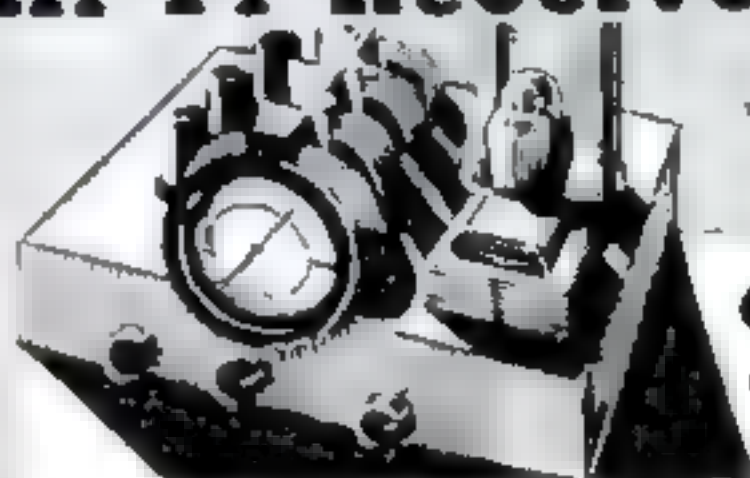
SPRING wooden clothespins are frequently used to hold negatives while drying, but the drying assembly illustrated is a somewhat novel adaptation of the idea. Holes are drilled through the pins above the springs so that they can be threaded on stiff wire obtained from a clothes hanger. Beads or short pieces of tubing may

be used to hold the pins apart. The free ends of the wire are then bent around and fastened into a hook. The principal advantage of this device is that the clothespins swing sideways, which enables negatives to be hung without disturbing others on the line.—S. J. GANCHER.

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10
DAYS
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TRIAL

Chemical Engineering for Home Experimenters

(Continued from page 209)

be just about at the proper temperature of 145 degrees C. If the aspirin starts to solidify toward the inside of the can, increase the heat; if it tends to flow from the open end of the glass tube, lower the flame.

Rotate the kiln by the crank handle, while you continue heating, for half an hour or so. You need not revolve the can continuously; just a turn now and then is sufficient to expose fresh portions of the mineral to the hot surface of the can, until the desired plaster-of-Paris product is obtained.

From a rocky white mineral called witherite, you can prepare glistening white crystals that will serve you in many of your home-laboratory experiments. This mineral, not at all uncommon, consists largely of barium carbonate. By dissolving it in hydrochloric acid, you can obtain barium chloride, for which you will find frequent use.

Place the powdered mineral in a beaker and add its own volume of diluted hydrochloric acid (made by mixing one part of strong hydrochloric acid, by volume, with two or three parts of water). Carbon dioxide gas escapes and the mineral partially dissolves. It will not dissolve entirely, since it undoubtedly will contain considerable quartz rock.

Warm the solution gently and add several grams (or a teaspoonful) more of the powdered mineral. If the powder effervesces, not all of the acid has yet been used up in converting the carbonate to the chloride. Make fresh additions of the powdered mineral until they are no longer acted upon, showing that the solution may be considered free of acid.

If you were to stop at this point, filtering the liquid and letting it crystallize, the crystals of barium chloride would be colored a rusty brown by iron impurities. Therefore further treatment of the beakerful of liquid is first required.

Passing chlorine gas through the liquid, before obtaining the crystals from it, will dispose of the iron. This should be done outdoors. Fit a small flask with a one-hole cork, carrying a piece of glass tubing that dips into the liquid in the beaker. Place in the flask a small amount of potassium permanganate crystals, or a spoonful of bleaching powder or of liquid laundry bleach (sodium hypochlorite). Potassium permanganate will work best. Now add to the flask about half a fluid ounce of strong hydrochloric acid. Chlorine gas will be

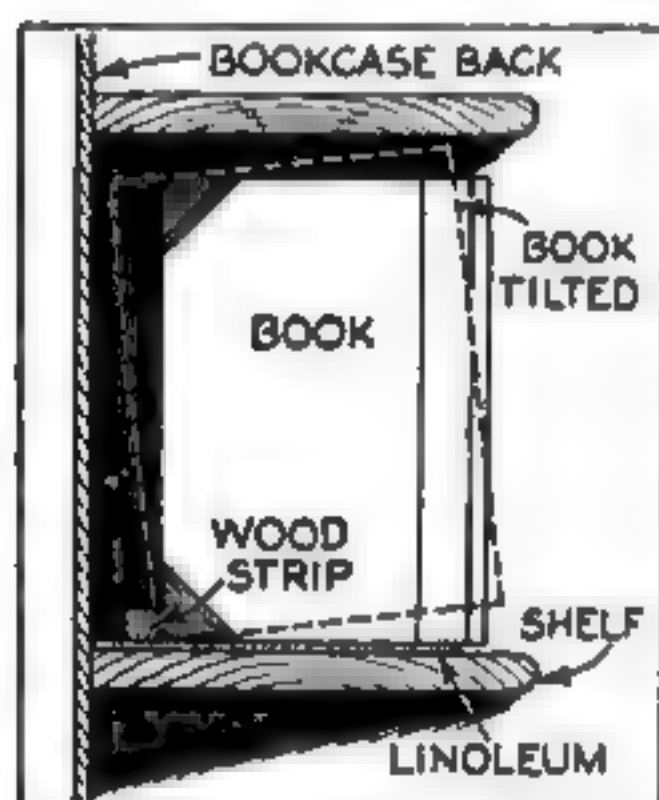
(Continued on page 244)



Stop Strips and Linoleum Improve a Bookcase

BOOKS, especially large volumes in sets such as encyclopedias, often fit between the shelves so snugly that it is difficult to remove any one of them. A simple remedy is to fasten a strip of wood about $\frac{1}{2}$ " thick along the top of each shelf at the back to serve as a stop. The books are placed on the shelves with their lower edges against the strips. When a volume is to be removed, the two books flanking it are pressed at the top to make them tilt back so that the desired book can be grasped with the fingers and drawn out.

An additional improvement is to lay linoleum on the shelves in front of the stop strips. This provides a smooth surface over which the books slide with little effort, and it also elevates the volumes so that the backs are not damaged by rubbing on the shelves. Linoleum also can be used to cover the stop strips if desired.—W. E. B.



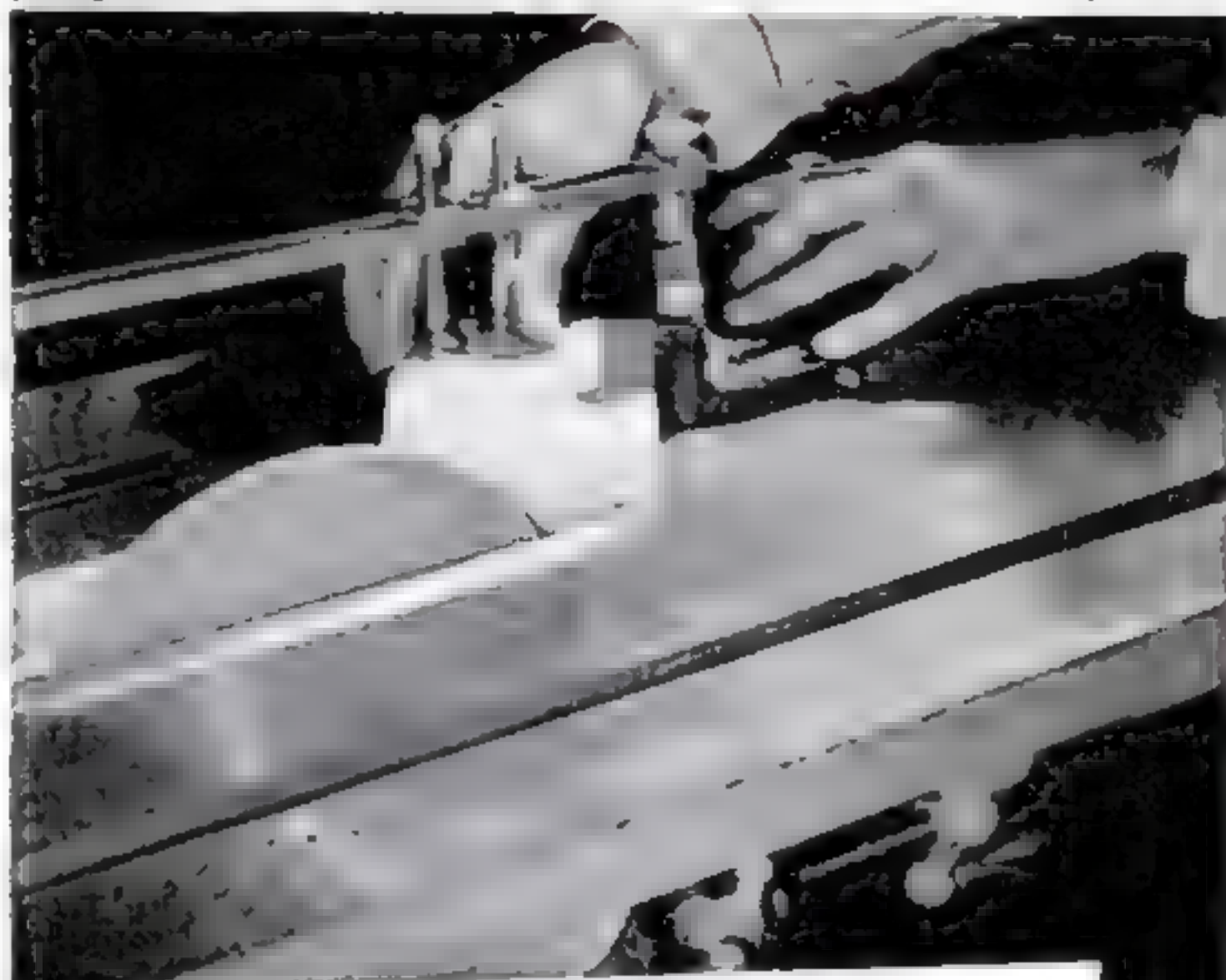
The shelf is faced with linoleum and a wooden stop placed at the rear

of the shelf. This provides a smooth surface over which the books slide with little effort, and it also elevates the volumes so that the backs are not damaged by rubbing on the shelves. Linoleum also can be used to cover the stop strips if desired.—W. E. B.

Worn Water Faucet Repaired by Drilling and Grinding

TO REPAIR a water faucet, the seat of which had become so deeply grooved that it leaked continually, I took the tap apart and drilled out the grooves with a $\frac{5}{8}$ " drill. This left the seat so rough that it would soon spoil the rubber washer, so I ground it smooth with valve-grinding compound applied on the head of a $2\frac{1}{2}$ " by $\frac{1}{4}$ " carriage bolt. The bolt was turned by gripping the threaded end in the chuck of a breast drill. By this method I avoided having to buy a faucet seat reamer.—RUSSELL C. FRITH.

SHORT CUTS FOR THE HOME CRAFTSMAN



How to sand a mitre cut on a circular saw!

• The smoothing by hand of the end grain of wood, particularly small blocks of hardwood, is a problem. But this difficulty can be overcome easily if you own a circular saw. Simply take an old saw blade . . . grind off the teeth . . . cover* one side with a coarse grit Aloxite Brand Aluminum Oxide Disc, the other with a fine-grit disc . . . and Presto! you have a highly efficient sanding machine. You can use such a disc sander not only for sanding mitre cuts, but in dozens of other ways that will save your time and make your work easier and more pleasant.

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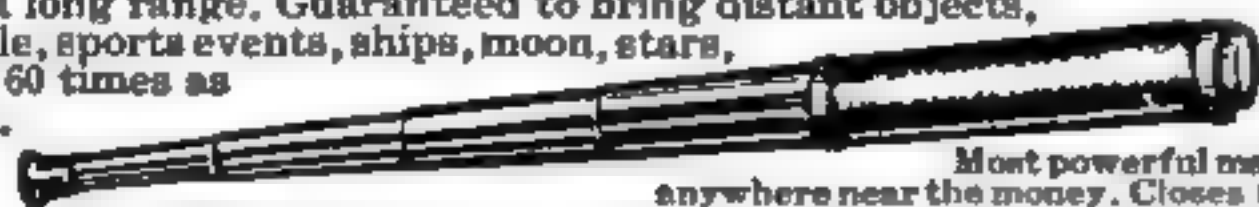
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Chemical Engineering for Home Experimenters

(Continued from page 242)

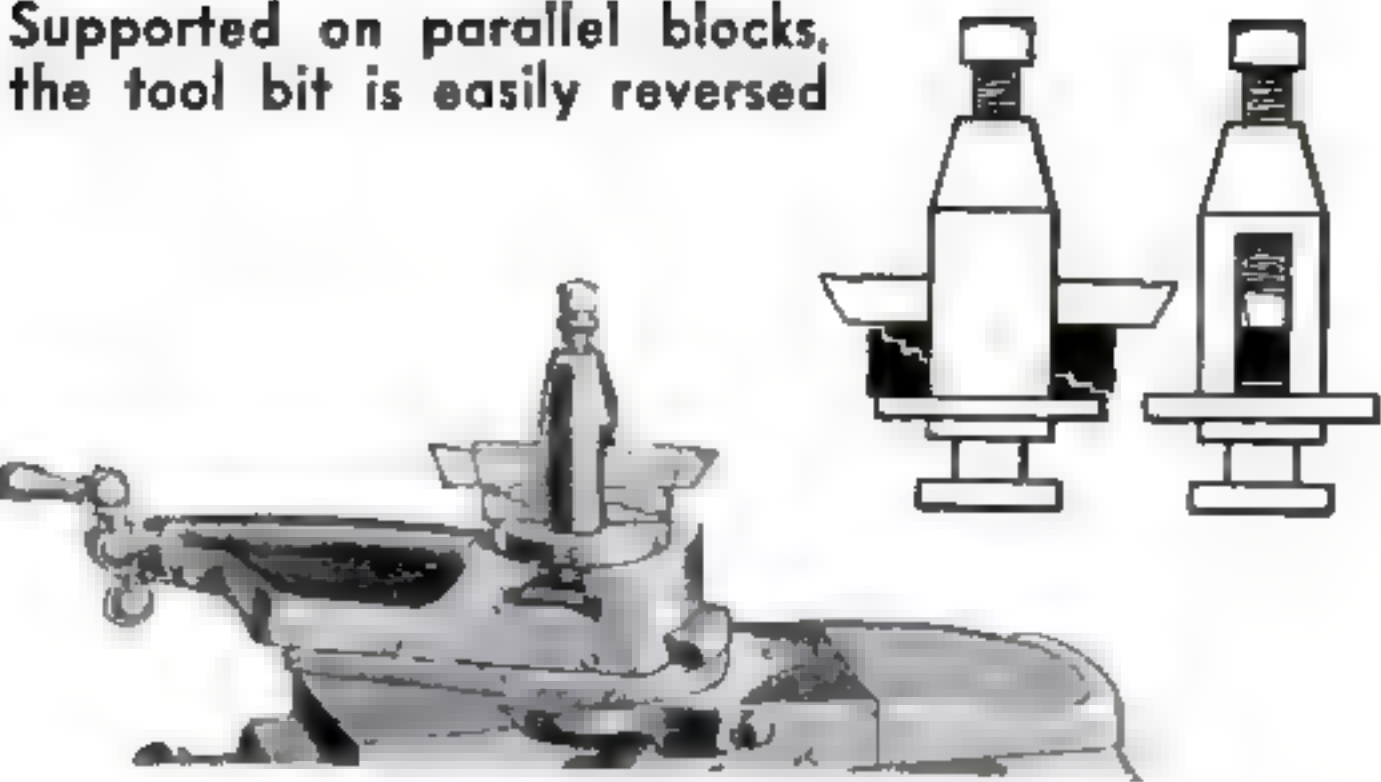
generated, and should be allowed to bubble for about half a minute through the beakerful of barium chloride solution and quartz residue. The result is that any iron impurities are precipitated at this point.

Now place the entire contents of the beaker, together with several grams more of powdered witherite, in a bottle and keep it stoppered for twenty-four hours or so. At the end of this time, filter out the worthless rock and the precipitated impurities, catching the filtrate in a porcelain evaporating dish. Wash the filter paper with fresh water, adding this filtrate to the first. When the liquid is now evaporated, gleaming white crystals of barium chloride will be obtained.

This final operation may be performed by heating the contents of the evaporating dish with a small flame, or with a homemade electric lamp-bulb heater previously described in this series (P.S.M., Aug., '39, p. 182). If you use the lamp-bulb heater, you can place the dish upon it and let the liquid evaporate completely, leaving the barium chloride crystals behind. Otherwise, separate a quantity of the crystals first obtained; then discontinue heating, and let the remainder of the liquid evaporate at room temperature. The crystals may be bottled, and preserved for use in your future experiments. For using the lamp-bulb heater with large evaporating dishes, you can make a special attachment as shown on page 208.

A small collection of minerals, such as the mineral "sets" offer, will provide many other interesting chemical experiments. Barium, strontium, and calcium minerals exhibit typical "flame colors" when moistened with a drop of hydrochloric acid and held in a blue flame. Barium compounds tinge the flame green; strontium compounds, red; and calcium compounds, a brick red of different hue. Powdered cryolite mineral, shaken in a test tube of water and allowed to settle, becomes almost invisible because its refractive index, or light-bending power, so nearly equals that of water. Shake a bit of powdered orthoclase mineral (common feldspar), with a drop of phenolphthalein solution, in a little water, and no visible color change will occur. Although the mineral is alkaline and turns the phenolphthalein red, the color is removed by adsorption, adhering to the mineral. To prove that the clear liquid is alkaline, none the less, let the contents settle and add another drop of phenolphthalein. This time the result will be a visible red color.

Supported on parallel blocks, the tool bit is easily reversed



Lathe Tools Blocked Up on Adjustable Parallels

ADJUSTABLE tool-post blocks of the type illustrated have several advantages. Tool bits, for example, can be ground left hand on one end and right hand on the other, and to change from one to the other is merely a matter of backing the set screw off a quarter turn and swinging the tool into cutting position. No centering of the tool is necessary as it is not cocked on an angle. In fact, it is a two-way turret. No tool holder is needed because a $\frac{3}{8}$ " tool bit fits in the slot, but of course that can be varied and $\frac{1}{4}$ " or $\frac{5}{16}$ " bits may be used according to the width of the tool slot. The parallels are $1\frac{3}{4}$ " long, $\frac{3}{8}$ " wide, and $\frac{1}{2}$ " high, and the parallel steps are 0.020" high and 0.080" long. The parallels should be made of carbon steel (S.A.E. 1090), hardened and tempered to a deep straw color.—CARL VON MOLTKE.

Light Worktable Constructed from an Old Oil Stove

NEEDING a small worktable for some model-making equipment, I rummaged around in the basement and found an old two-burner oil stove. I removed the oil pipe and burners, replaced the top with $\frac{3}{4}$ " plywood, and added a shelf in the space formerly occupied by the burners. These changes and a coat of paint produced a table at a cost of about fifty cents.—LESTER C. TAYLOR.

Fastening a Bottle Decapper

ALTHOUGH various wall-type devices are sold for removing the caps from bottles, one of the most convenient can be made from an ordinary flat metal bottle decapper of the hand type. Drill three holes for wood screws in the handle end and bend the metal slightly in the middle; then fasten it to the end of the kitchen cabinet or in some other accessible place where a basket can be placed underneath to catch the loose caps as they fall.—A. W. STEIN.

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Exploring Insect Eyes with Your Microscope

(Continued from page 215)

and observe the images or record them with a camera attached to your microscope. Hold the tip of a dissecting needle or tweezers between the microscope stage and mirror, and focus until the images of the tip, one formed by each lens of the insect eye, are sharp. Another way is to reflect the image of a window or other bright object through the lenses with the substage mirror. For forming images, the cornea should be in air on the slide, rather than mounted in balsam or in water, so that light passing through it to the microscope lenses is hindered as little as possible.

In addition to the compound eyes, insects generally have a few simple eyes. These seem to be identical in structure to the elements of the compound eyes. You can recognize them by their hard, bullseye appearance. A honeybee, for example, has three of these eyes, located on the front of the head, between the two compound eyes. Spiders, which are not insects, do not have compound eyes, but have a group of single ones arranged in various patterns near the front and top of the head. There usually are eight eyes in such groups, although the number occasionally may be somewhat greater or somewhat less.

Some insects do not have compound eyes, particularly the parasites that would have little or no use for them. The common dog flea, for example, has merely a pigmented spot for each eye. A flea, in getting around, apparently does not depend much on the sense of sight.

Insect heads can be mounted whole on a slide, so the eyes and other parts can be studied. A method of doing this is, briefly: Prepare a strong solution of potassium or sodium hydroxide (ordinary laundry lye will do), and immerse the insect head—or whole insect if it is a small one—in it. Cork the container tightly, and set it aside for several days. The lye removes the fleshy parts but does not affect the chitinous outer skeleton. In doing this, it increases transparency. After clearing in the caustic solution, soak the head in several changes of clear water, then dehydrate with alcohol or dioxan and mount in balsam. **CAUTION:** in handling the hydroxide solution, keep it off your skin and clothes.

Very small insects need not be treated with caustic. They can be soaked several days in turpentine to clear them, then mounted directly in balsam.

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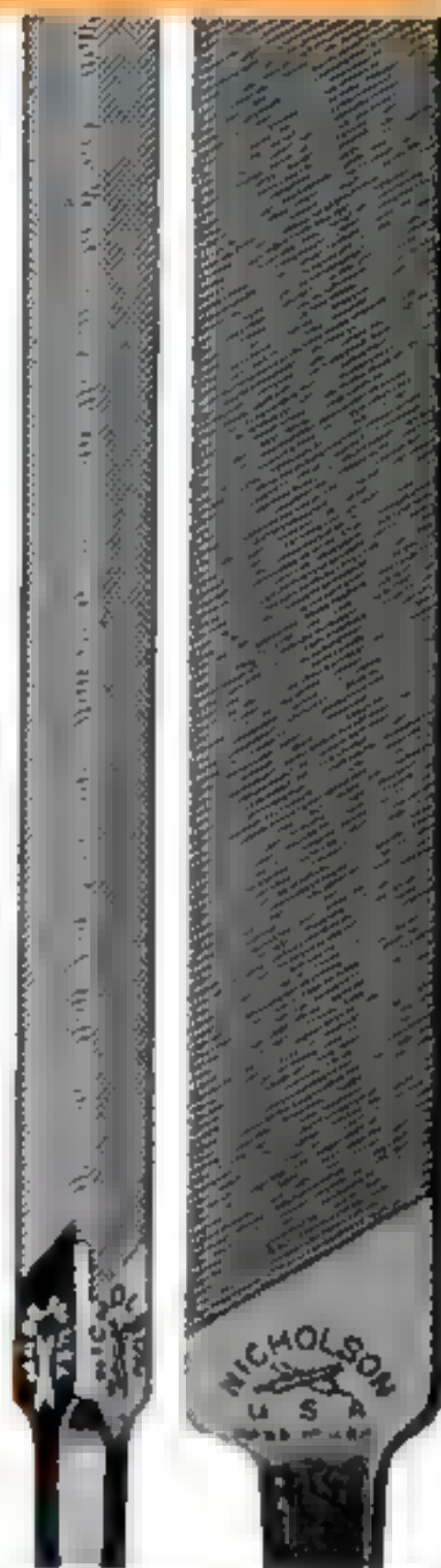
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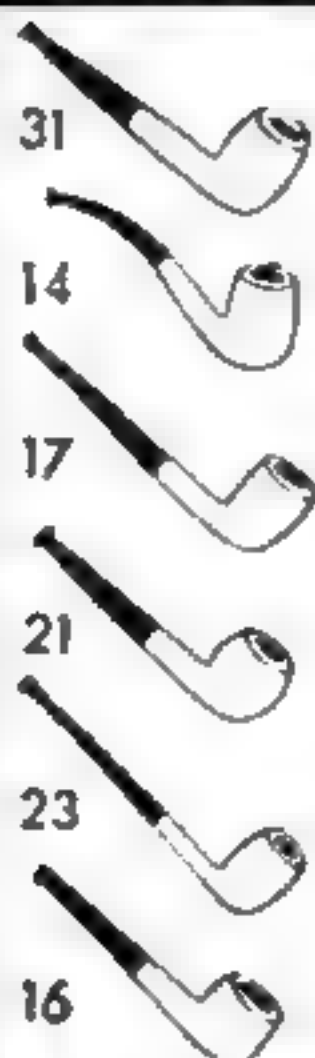
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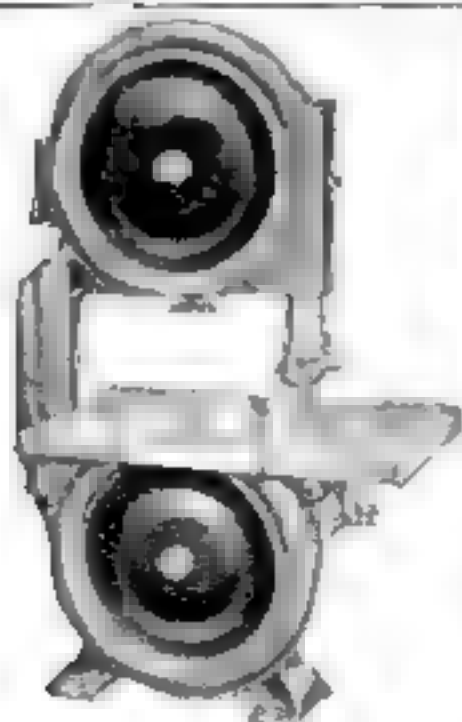
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- | | | | | |
|------|------|-------|-------|-------|
| 1. b | 5. c | 9. a | 13. b | 17. e |
| 2. b | 6. b | 10. c | 14. b | 18. c |
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"COLD water on your face, hot water on your razor"—that is the recipe for a smooth, pull-less shave, according to Peter N. Peters, authority on cutlery. By chilling the skin before shaving, Peters explains, you increase the firmness of the tissues that surround and support the hair follicle, so that the beard will not bend before the blade. By holding the razor under the hot-water faucet frequently during shaving, you apply heat to the hair to soften it and decrease its resistance to shearing. A diagonal rather than a "hoeing" stroke is recommended to those using safety razors.

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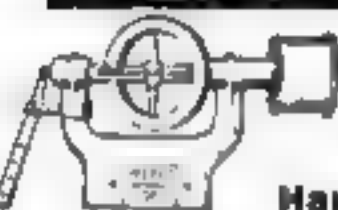
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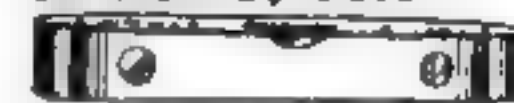
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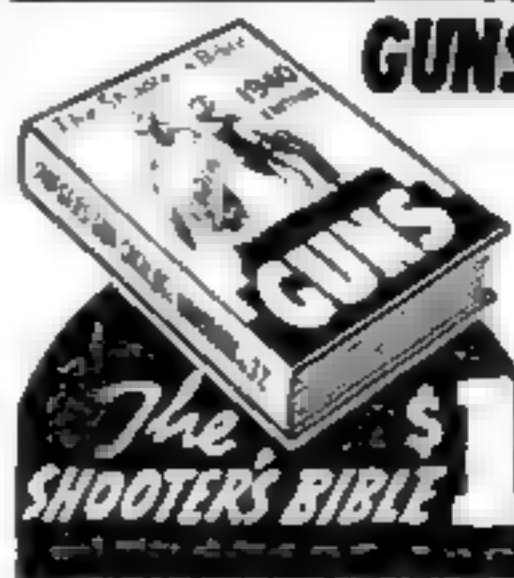
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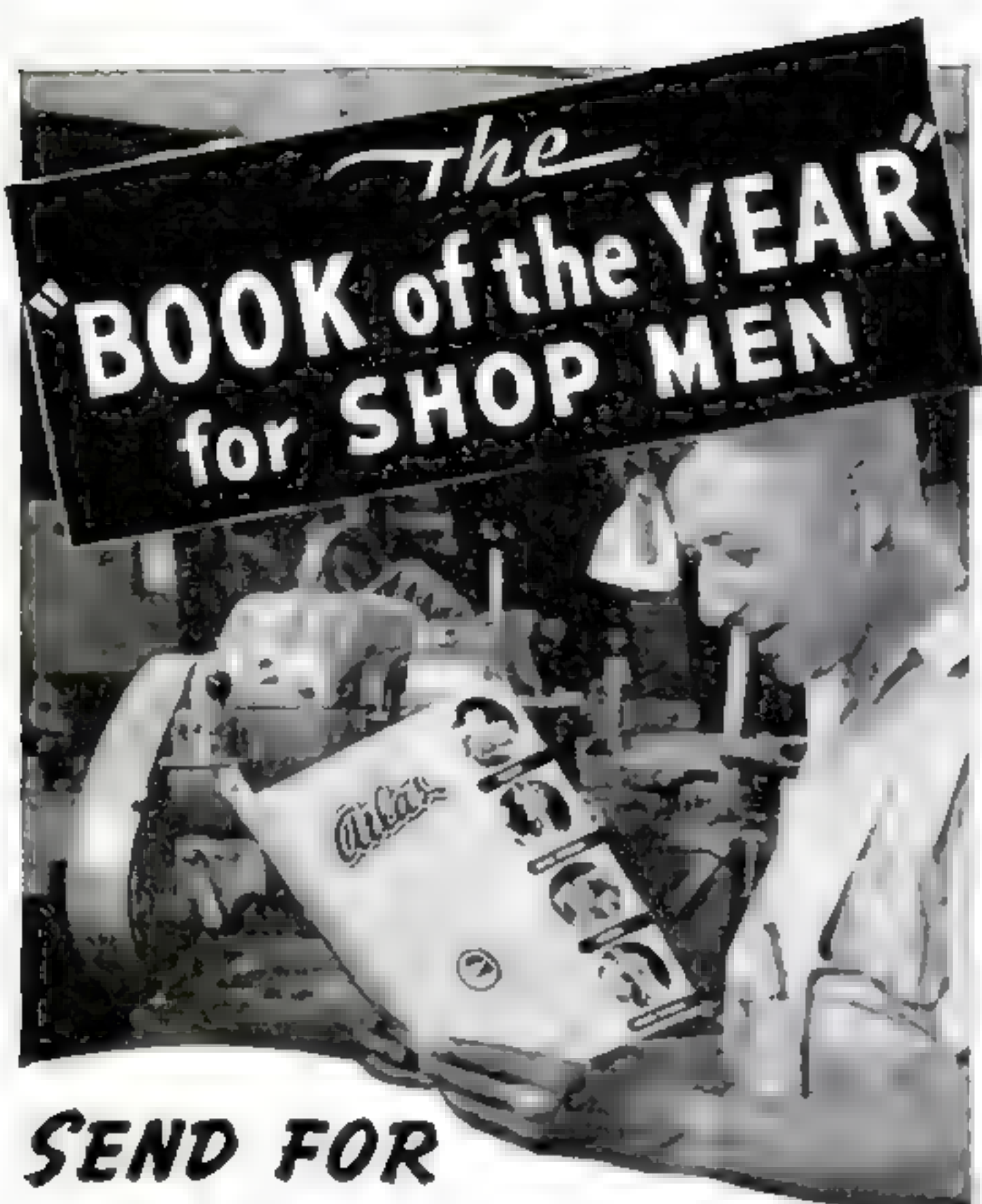
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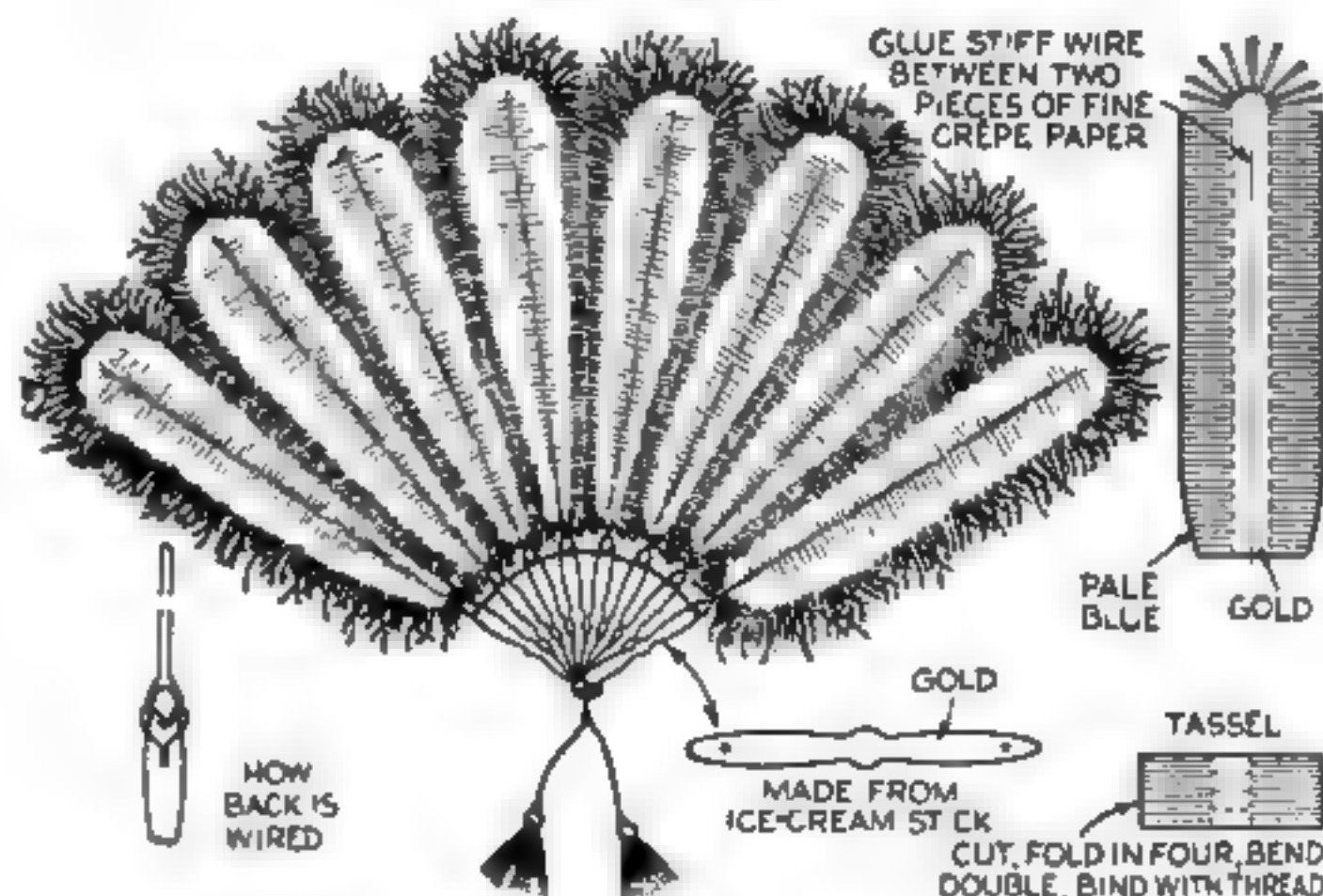
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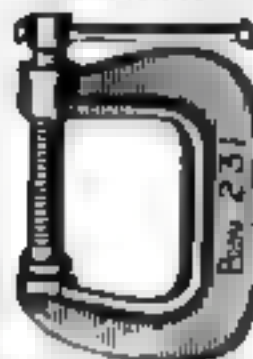
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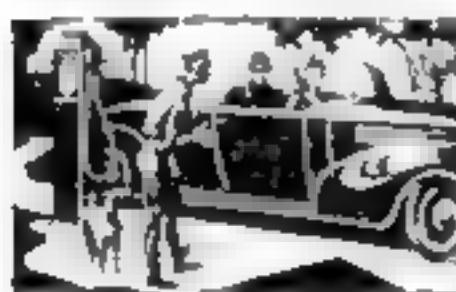
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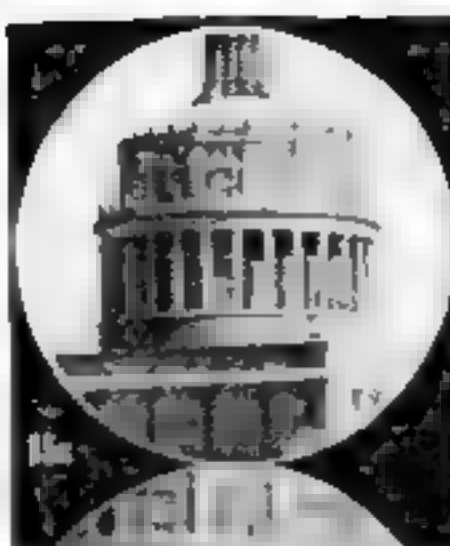
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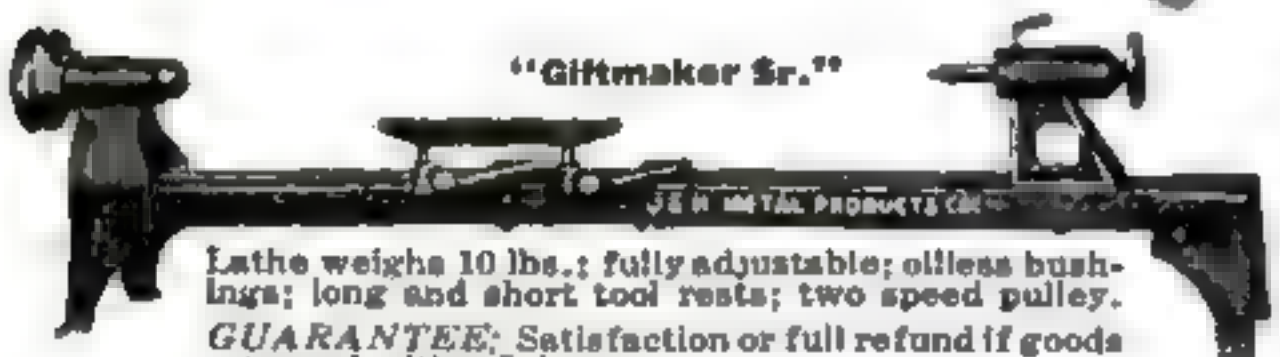


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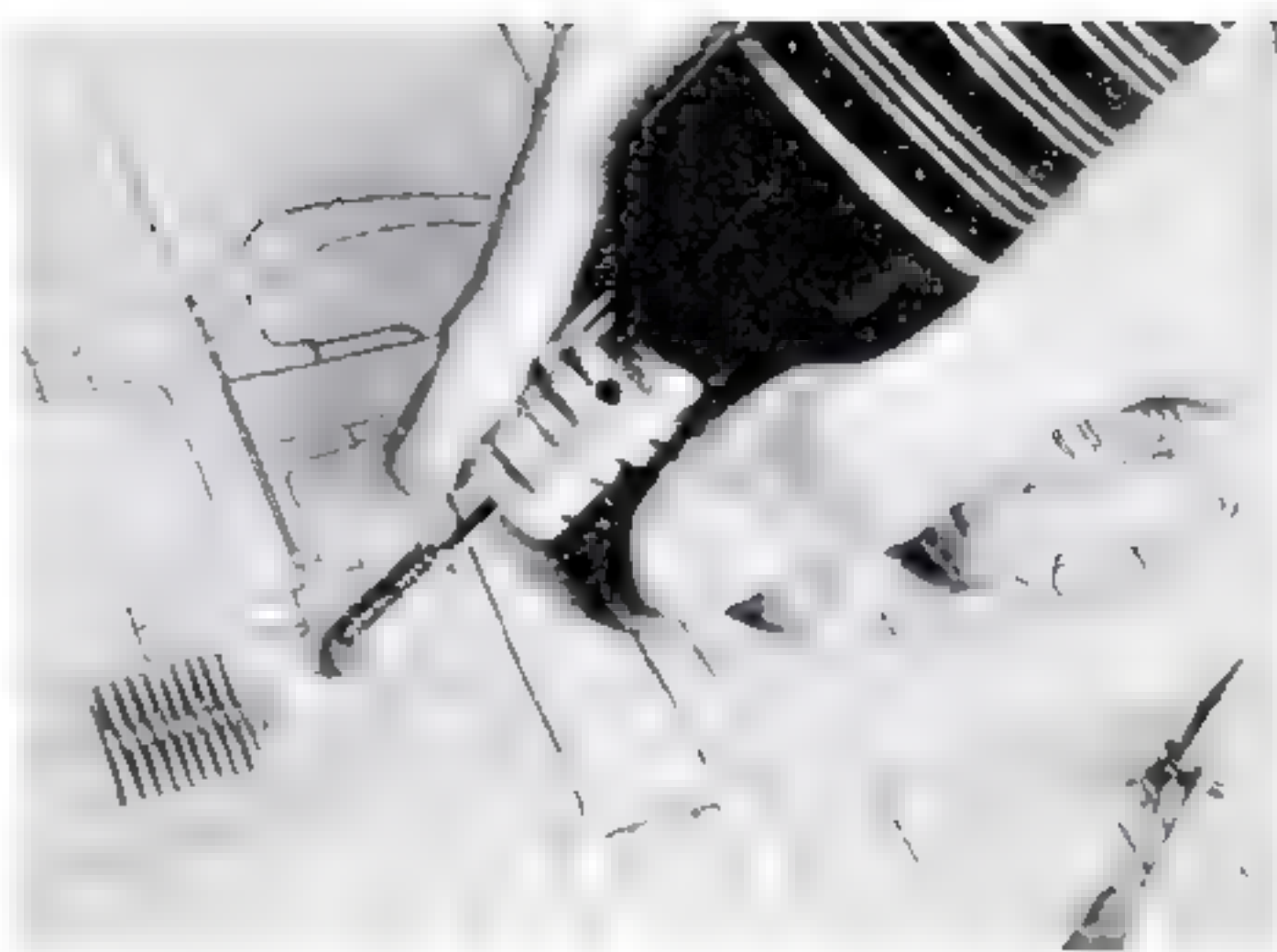
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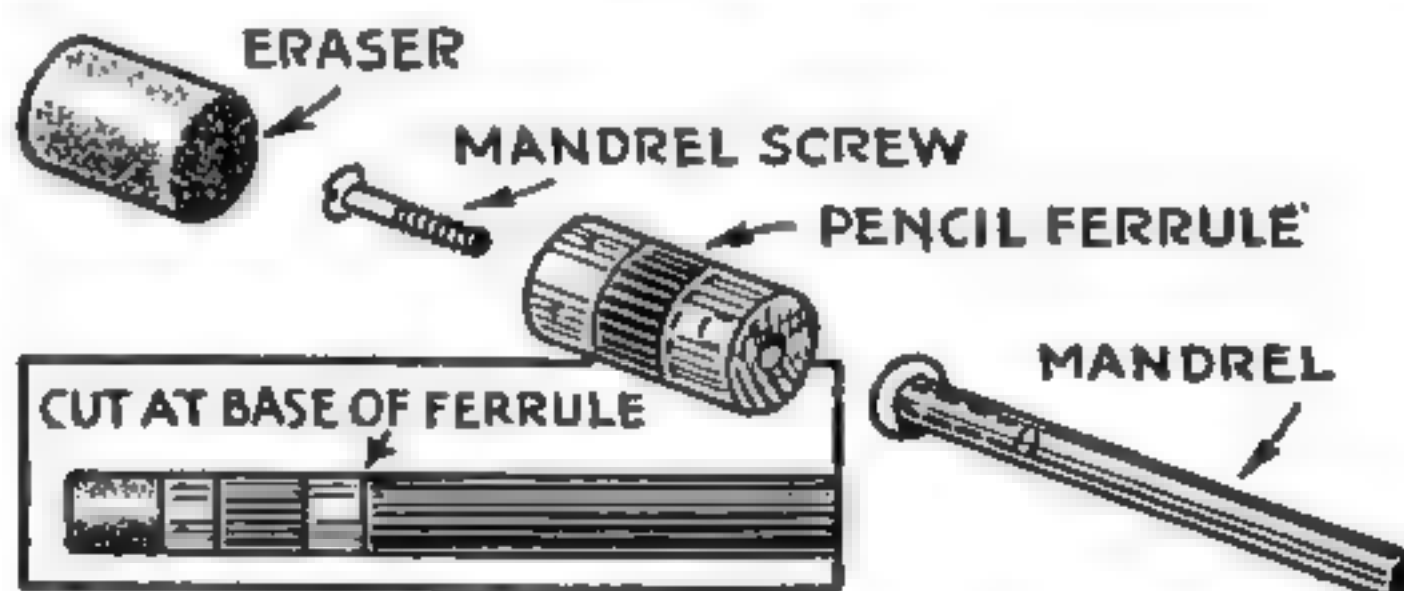
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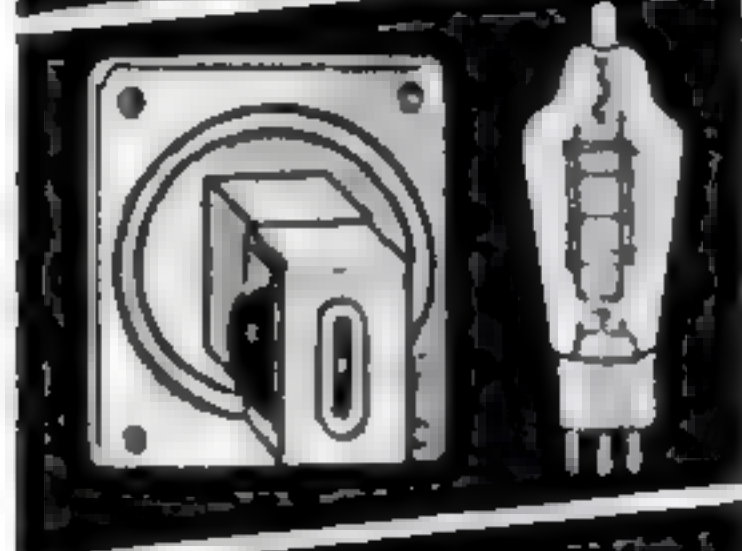
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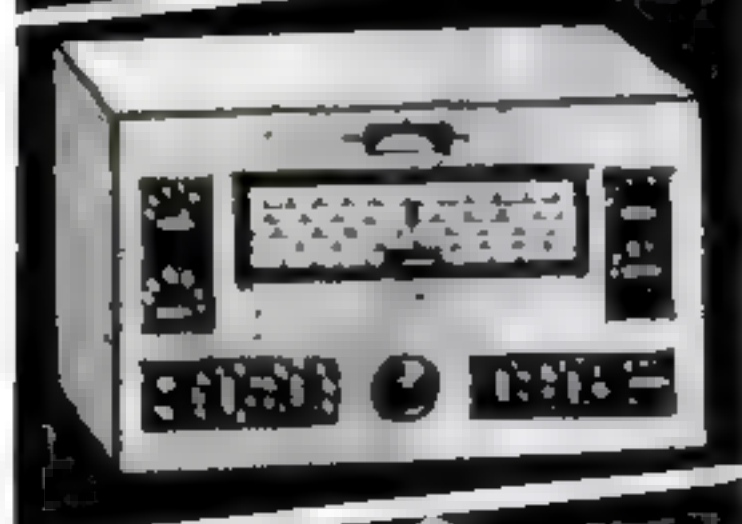
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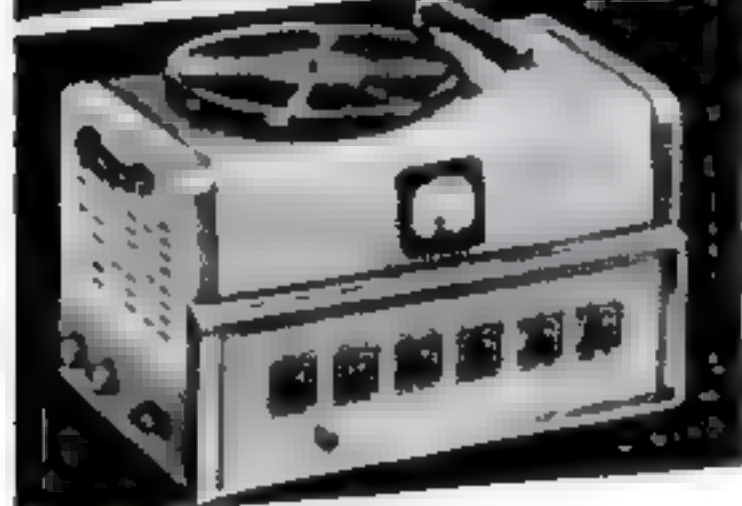
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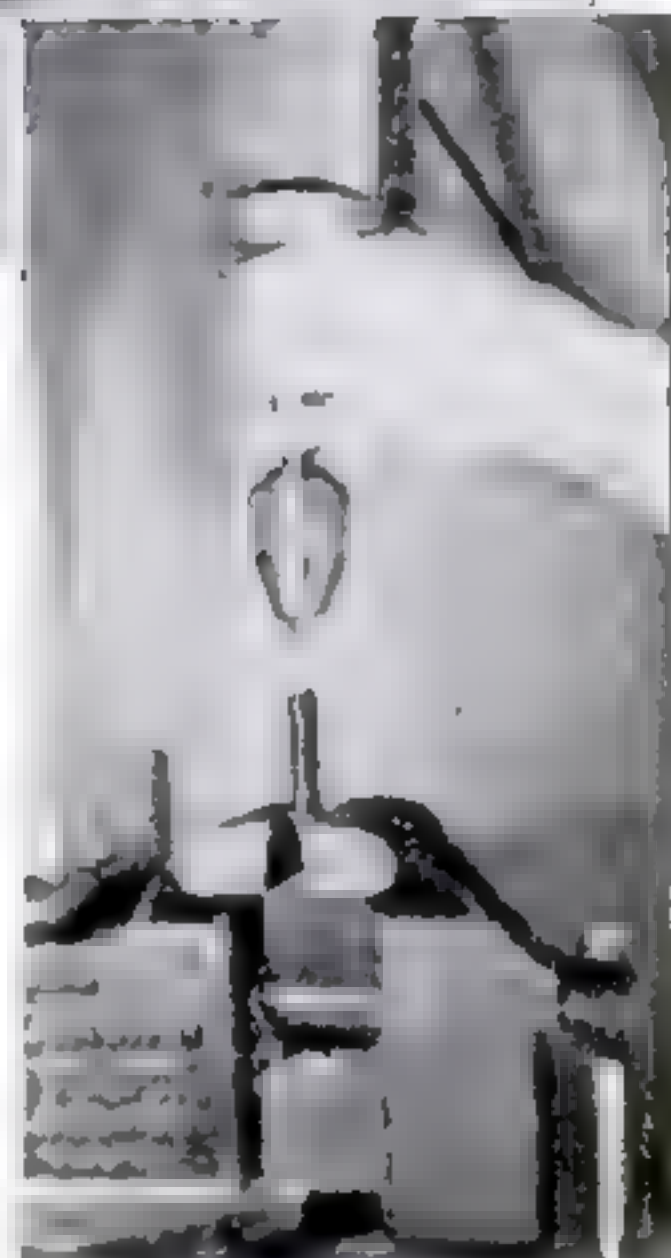
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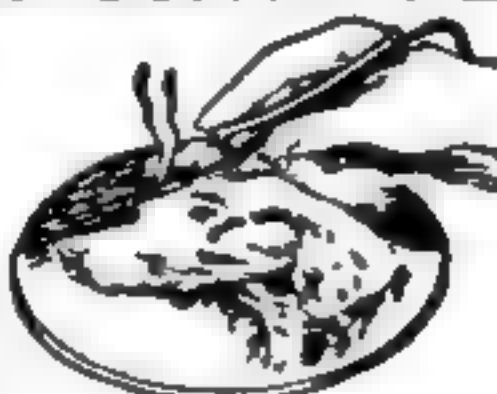
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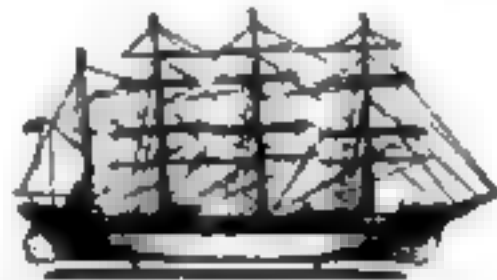
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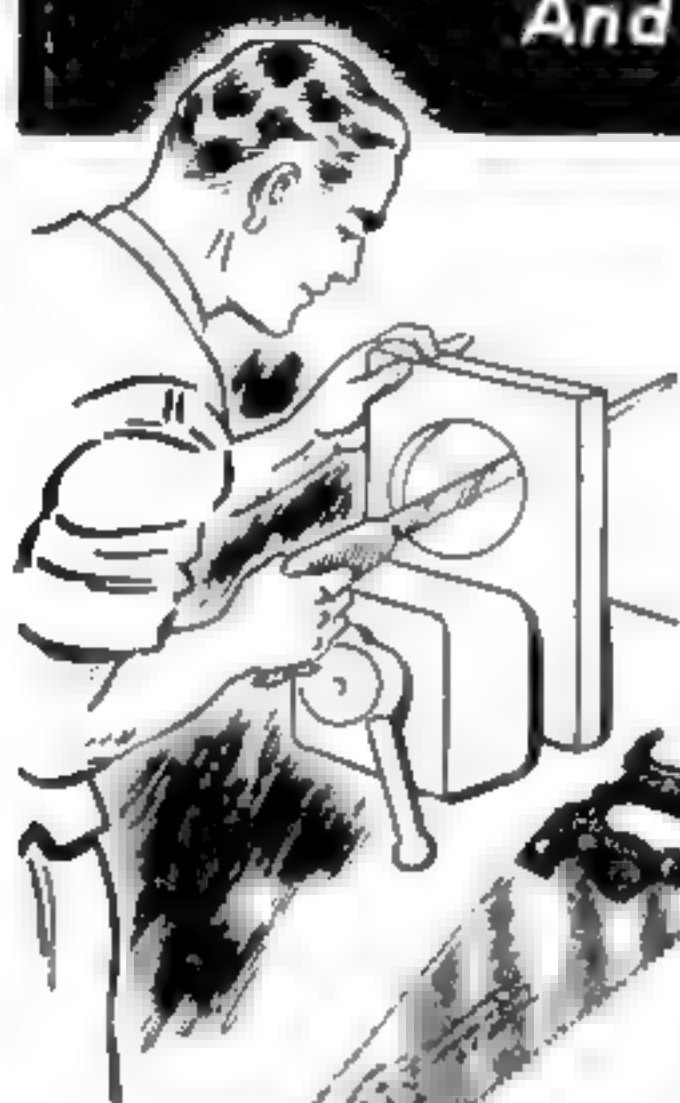
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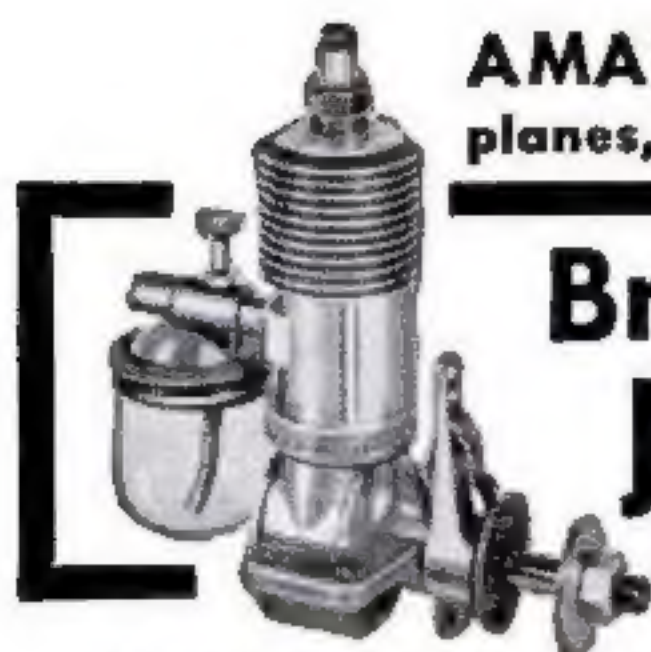
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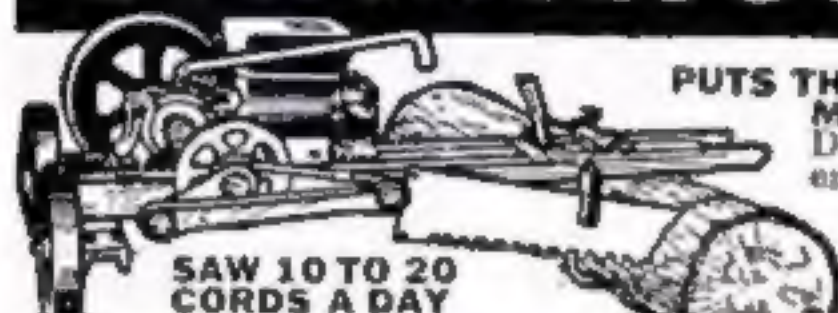
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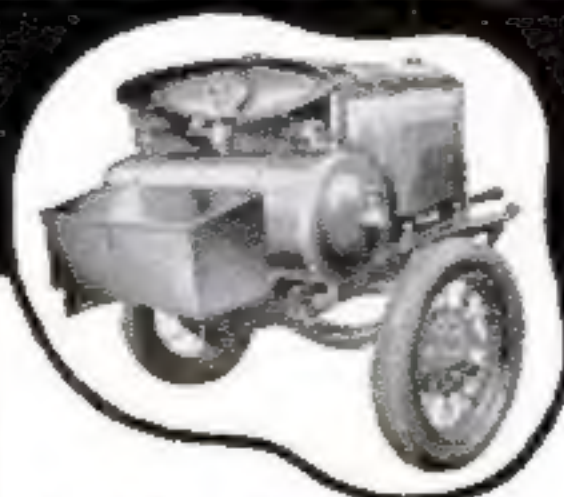
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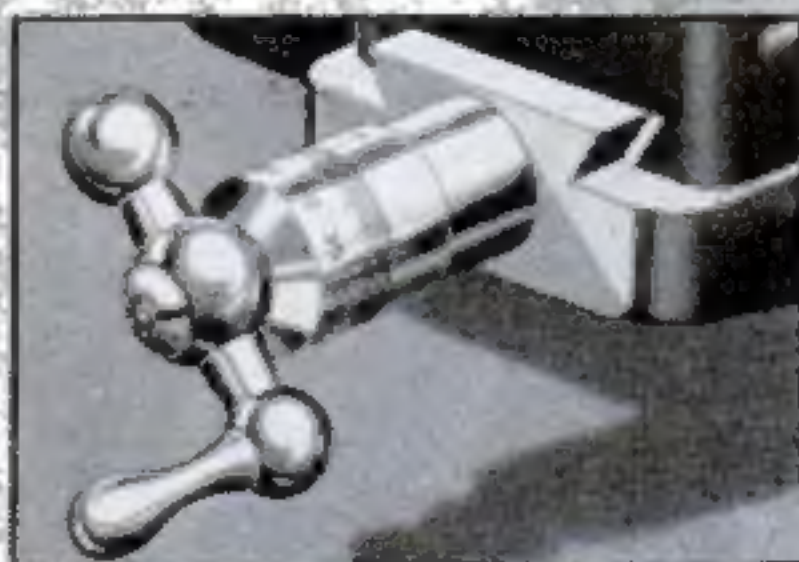
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